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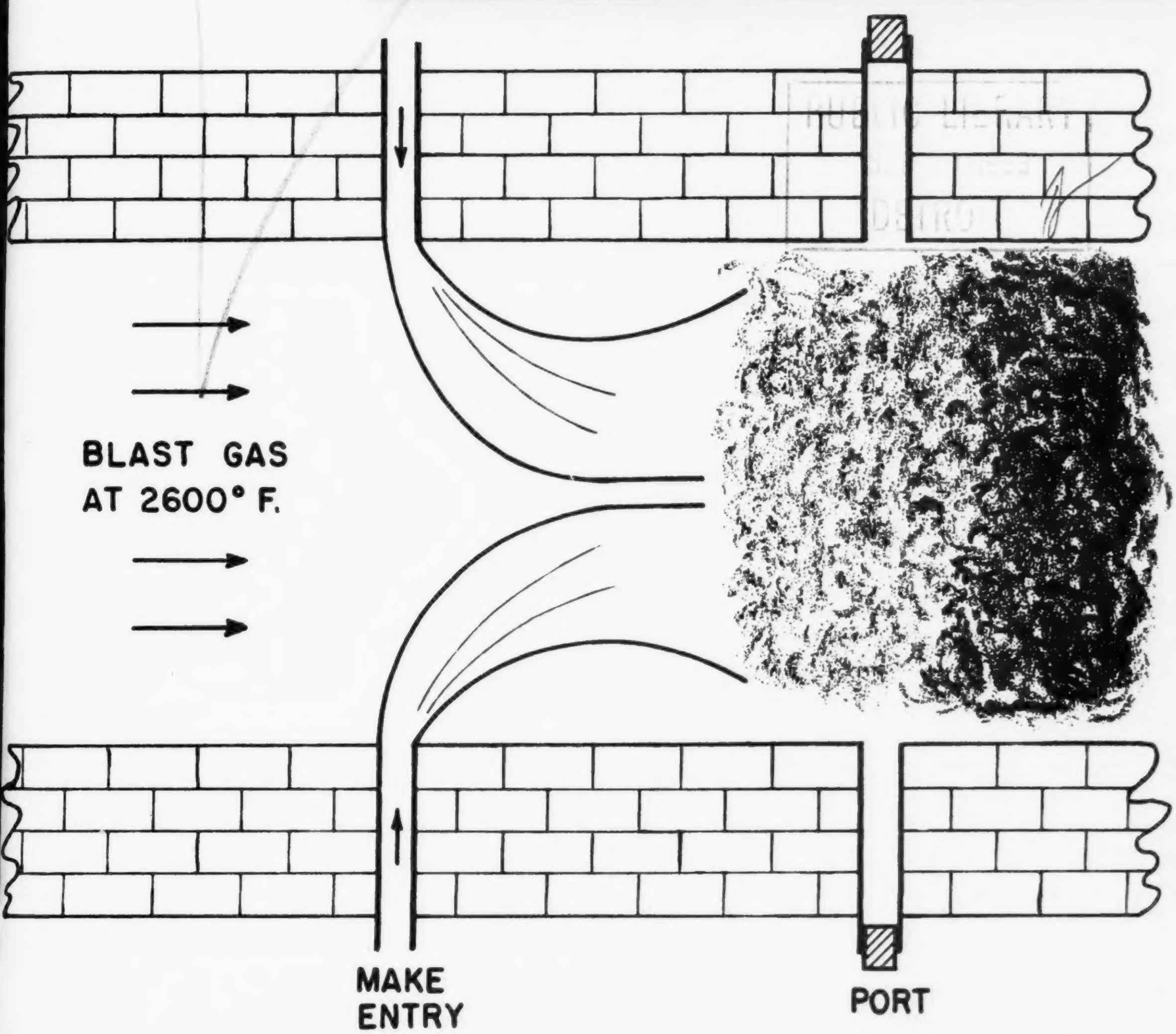

THE FORMATION OF CARBON BLACK IN HYDROCARBON FLAMES

By C. W. Sweitzer and G. L. Heller, page 855

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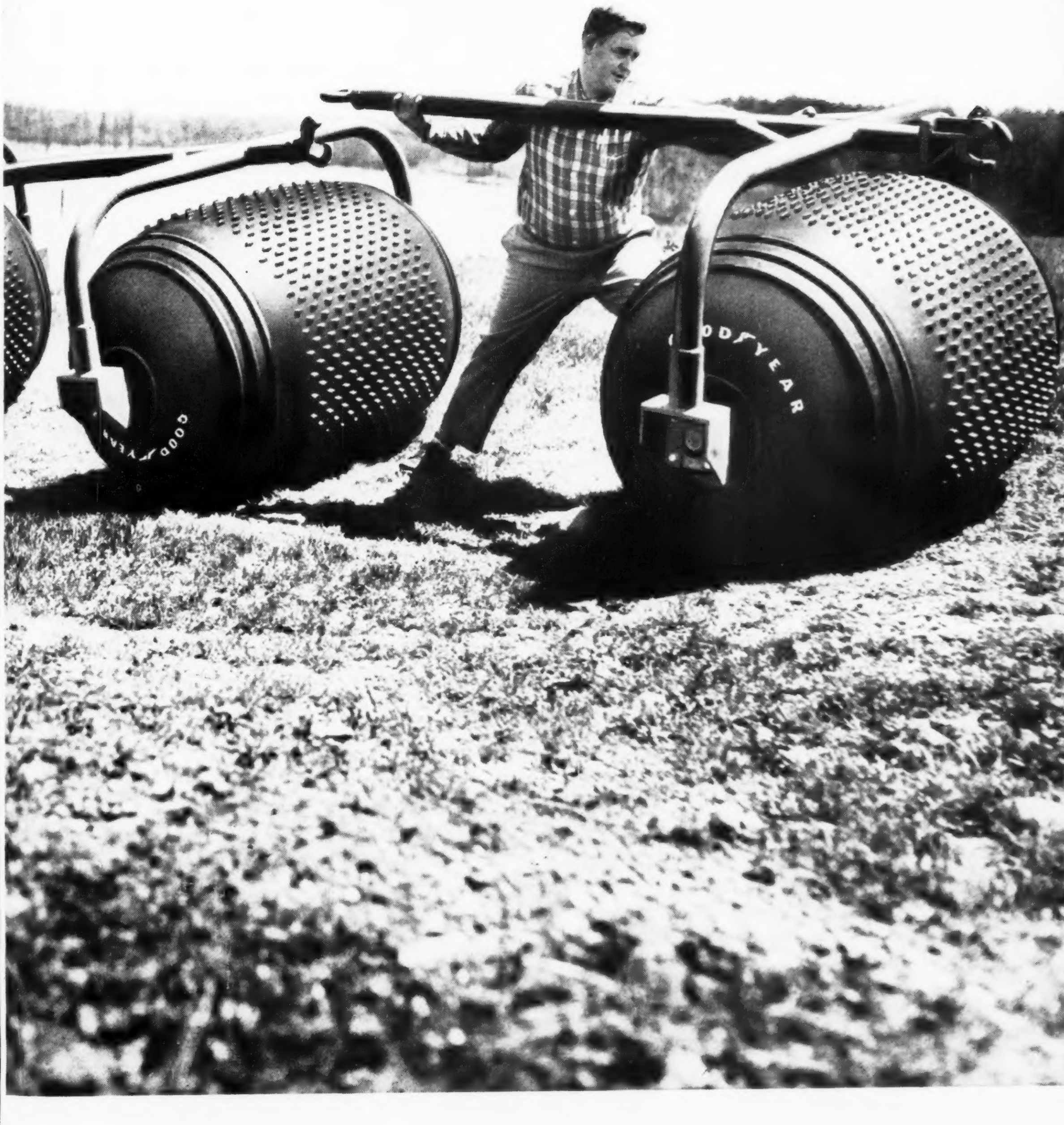
their own!



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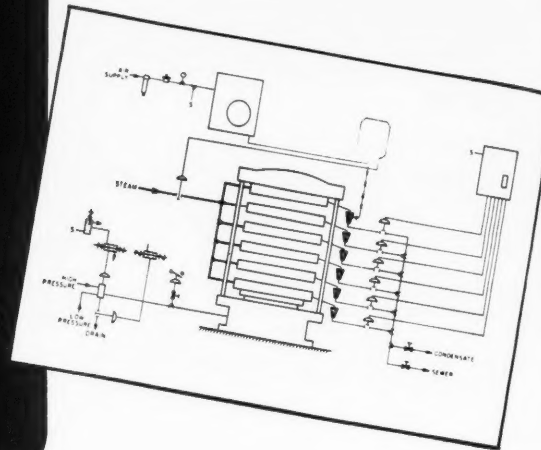

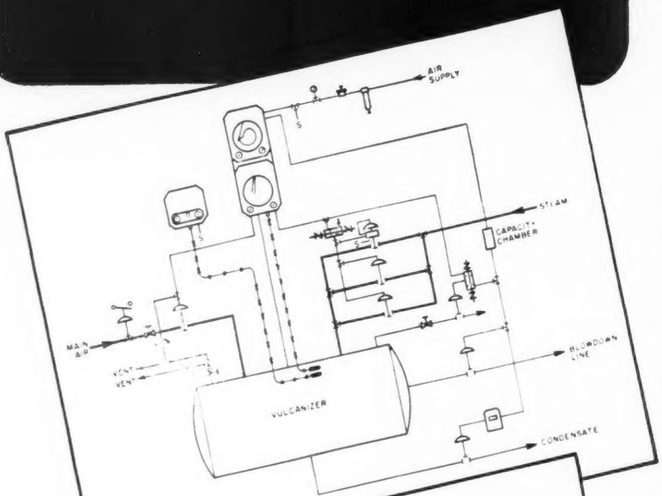

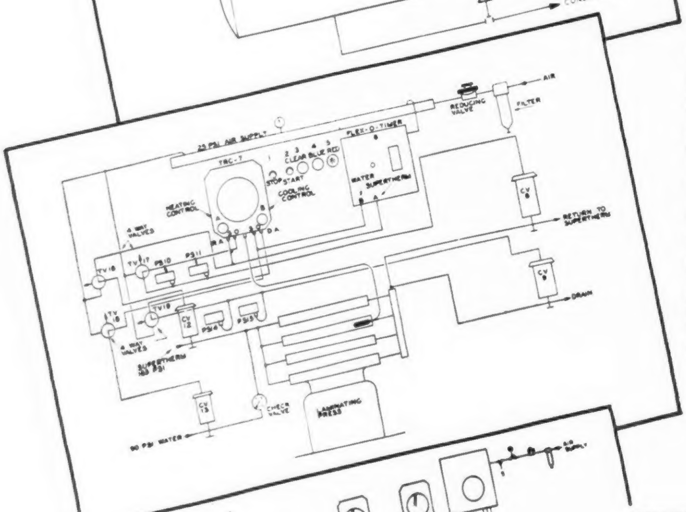

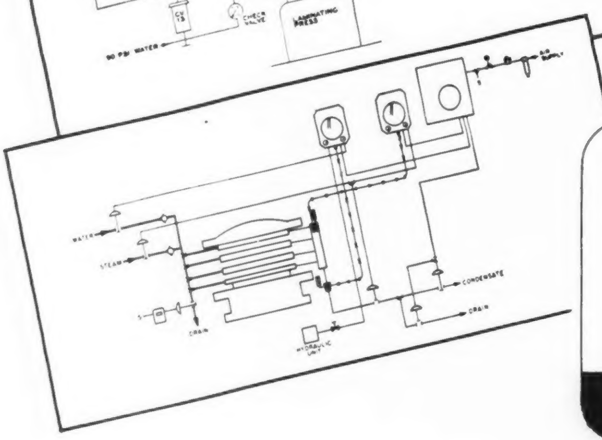

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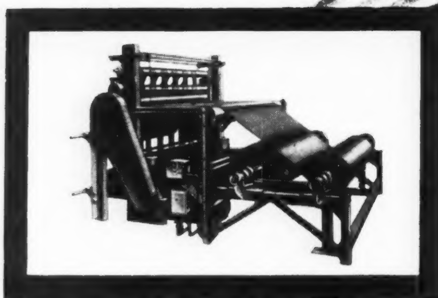

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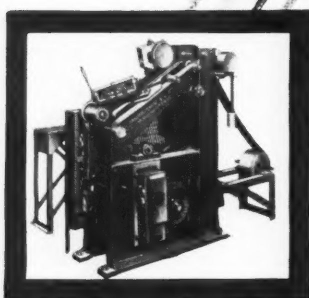

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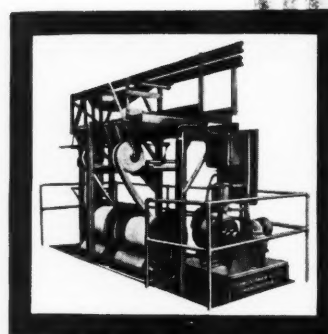

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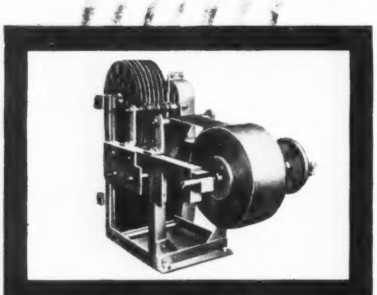

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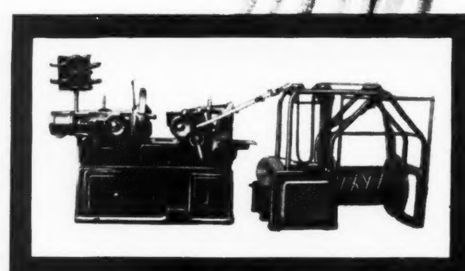

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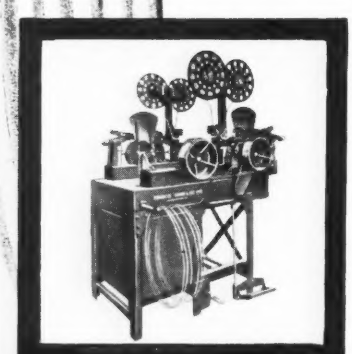

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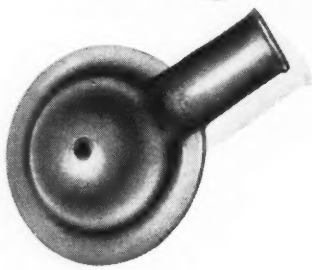

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From Traders To Tourists

THE articles of commerce required in the first business operations on the North American continent were simple, indeed. Colorful blankets, woolen and cotton cloth, beads, trinkets, paint, iron, awls, rum and whiskey — these were used in the fur trade between the European and the American Indian.

As distances from the seaboard to the interior lengthened — particularly from the French settlements on the St. Lawrence, Quebec and Montreal — transportation became more and more important, especially as competition between nations increased. The fur traders relied on that wonderful product of the Indian — the canoe. Over limitless waterways and backbreaking portages the first exchange of goods was carried on and a continent began to be opened up.

Today in this area the white waters of turbulent rivers and the placid and stormy waters of lakes still flow, but the land is settled, and commerce of worldwide importance takes place in this land of fur-trader, voyageur and hunter.

And today this is also the land of the tourist — the motor tourist — who comes to see and enjoy the shining waters of the lake country. This, too, is a new industry, comparatively speaking. Touring on the modern scale began when the rubber tire became more dependable and the family car could conveniently journey hundreds of miles from home in a very short time. The moment of new dependability came when carbon black was added to rubber — longevity, hard wear and greater comfort were the results. United Blacks have been in the forefront of this progress, a standard of excellence in the United States, the provinces of Canada and throughout the world.

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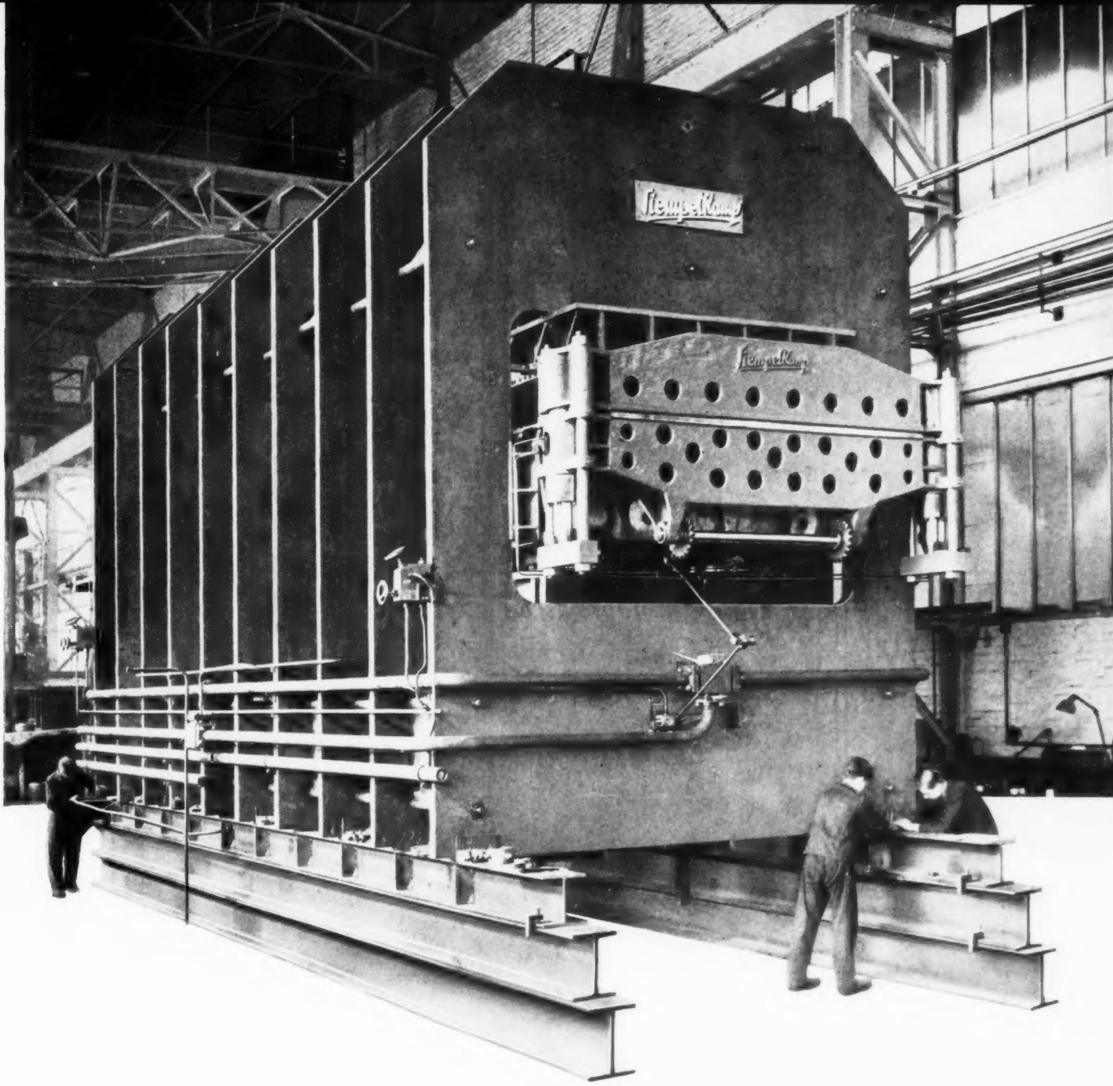

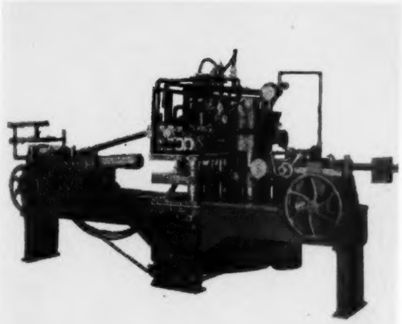

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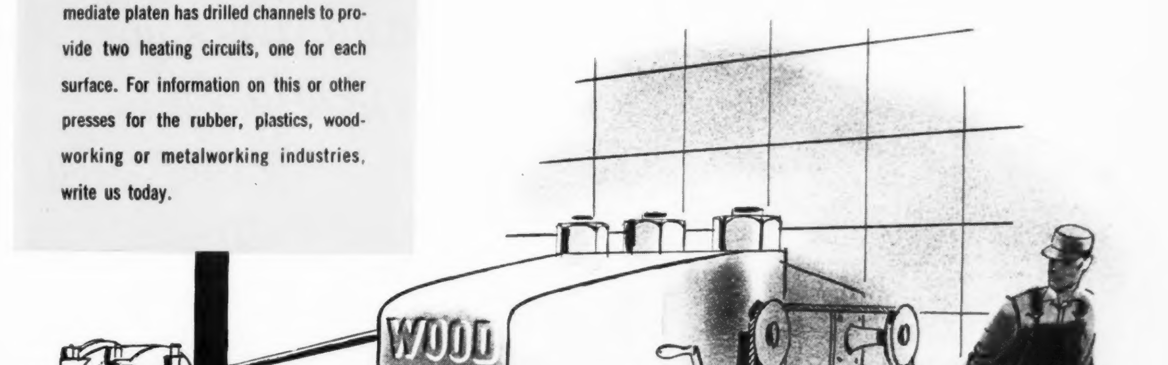

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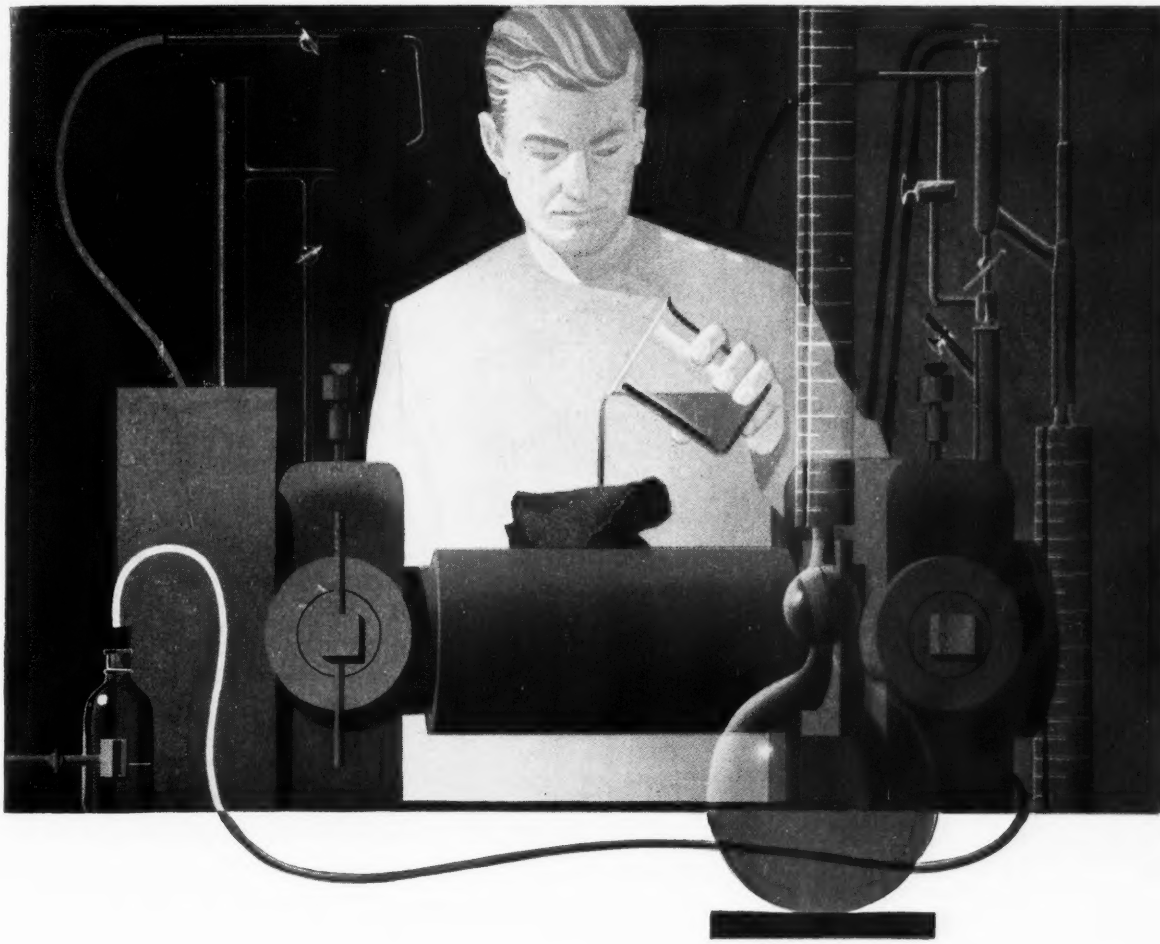

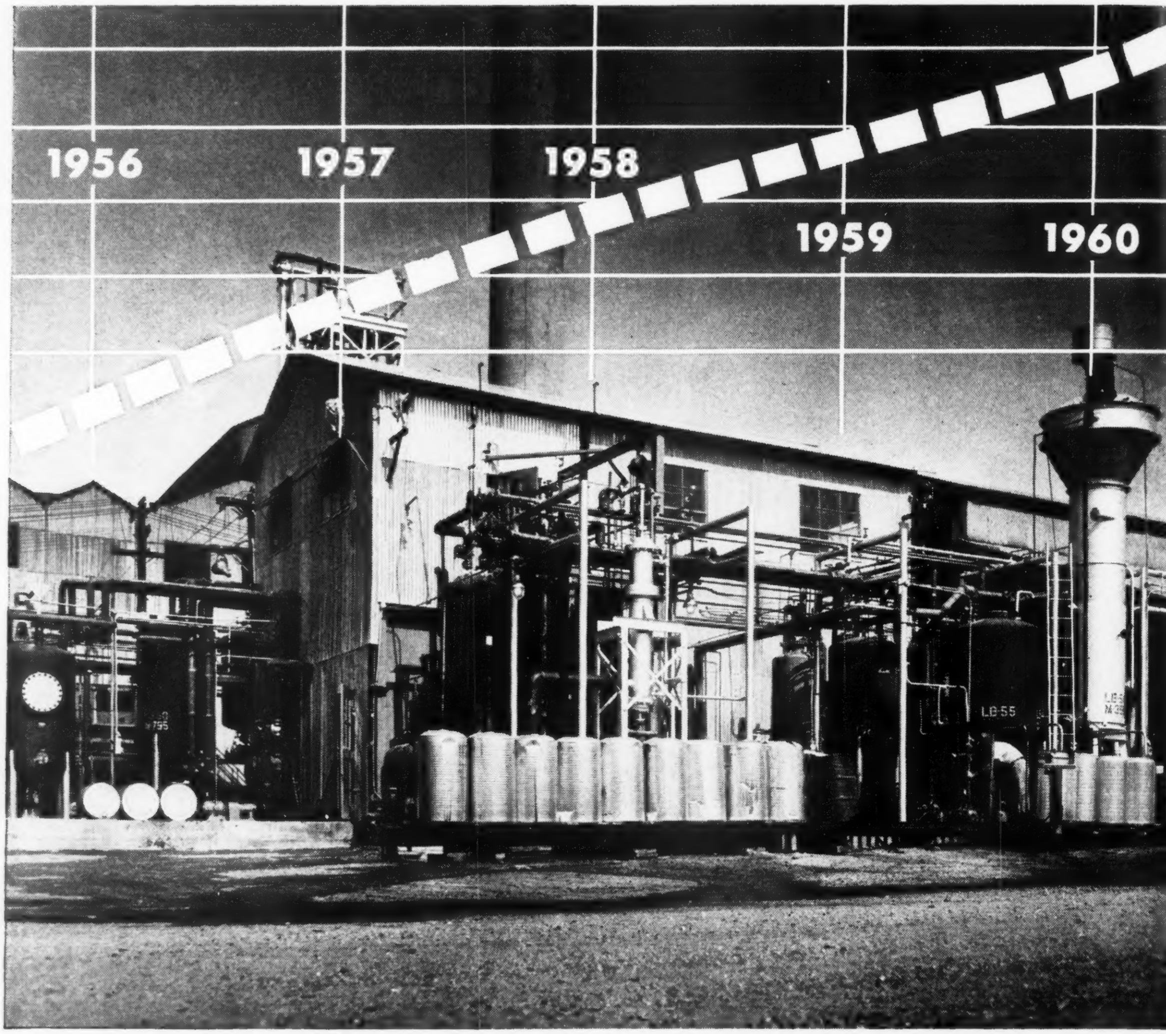

LOOKING AHEAD—This pilot plant is typical of Hercules facilities devoted to the development of new products for the rubber industry. Chart of future rubber consumption is projected on the basis of government statistics.

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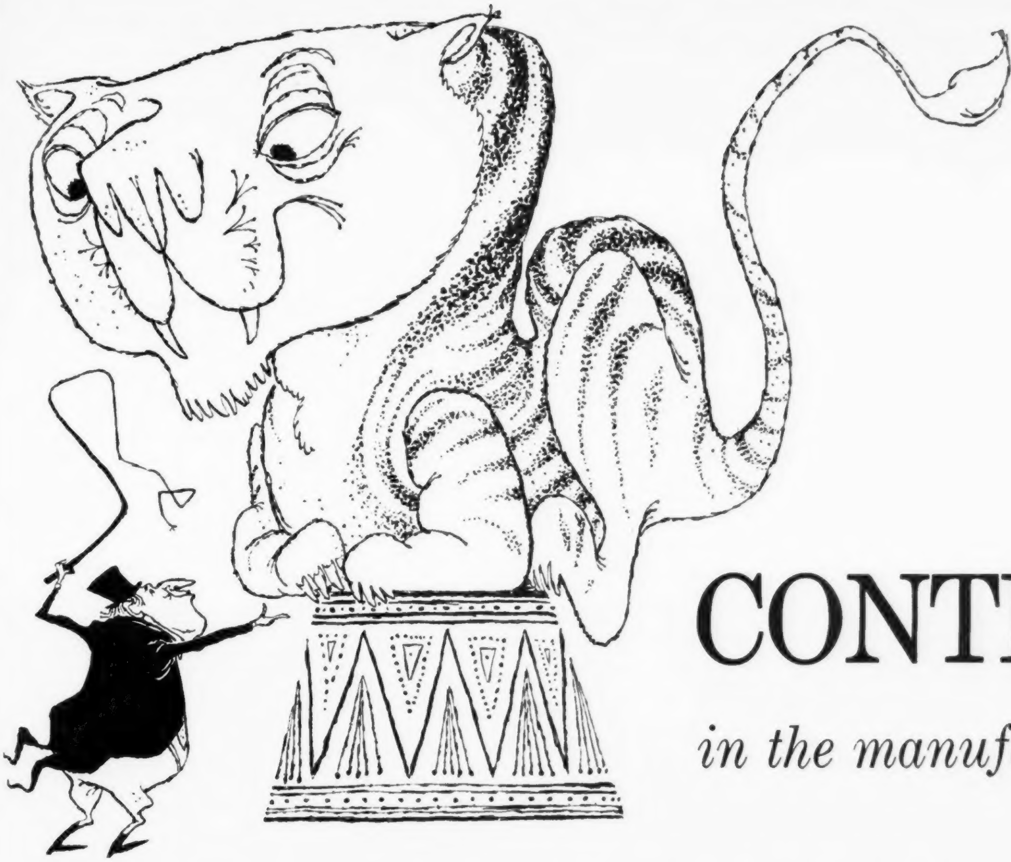

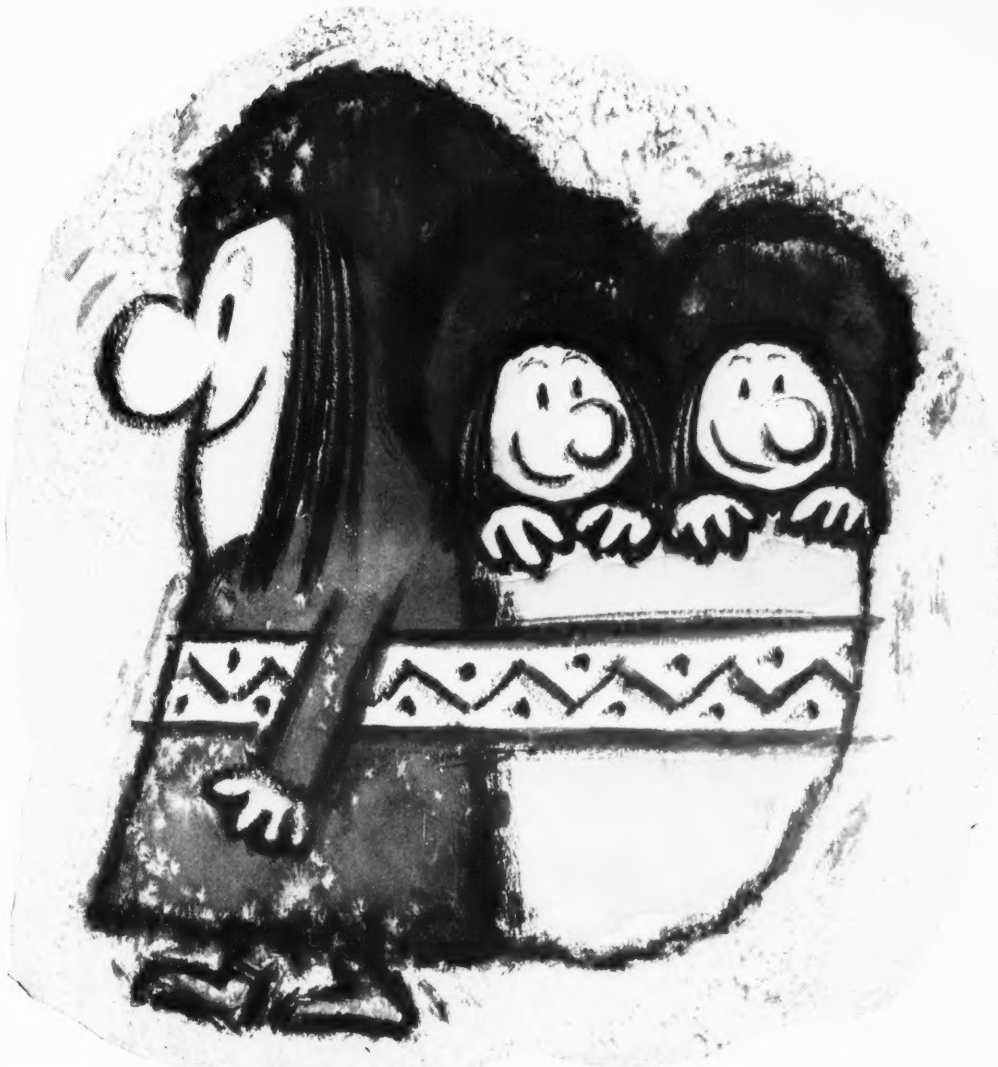

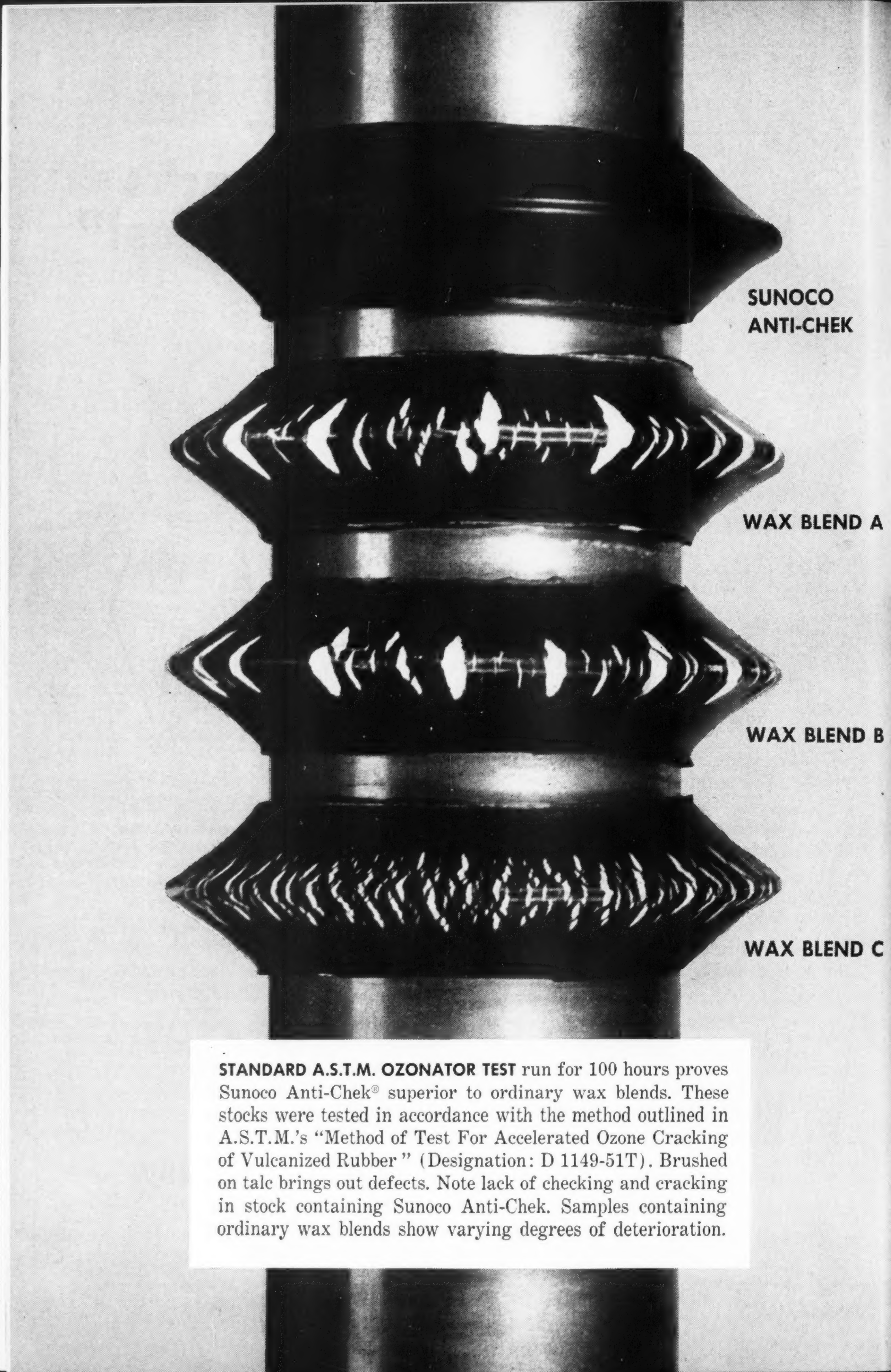

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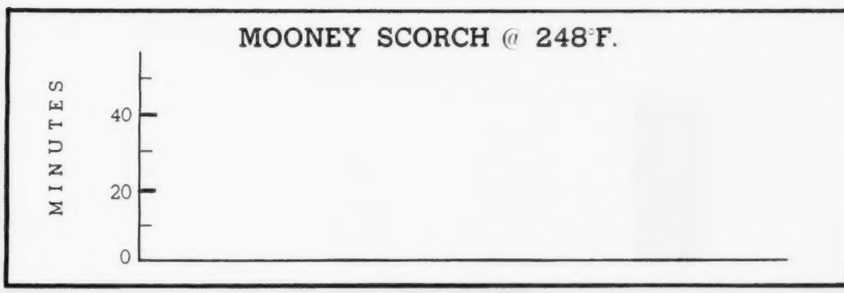

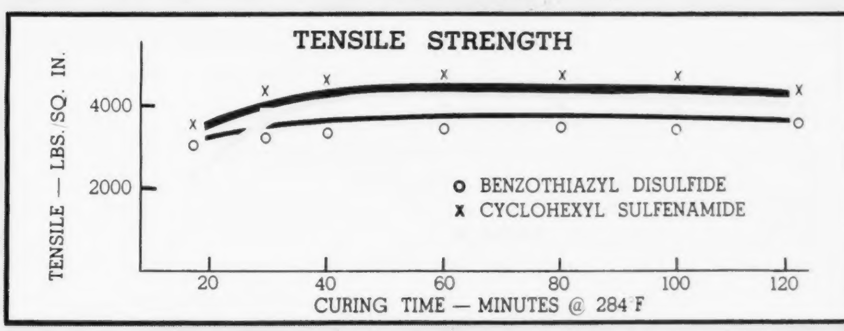

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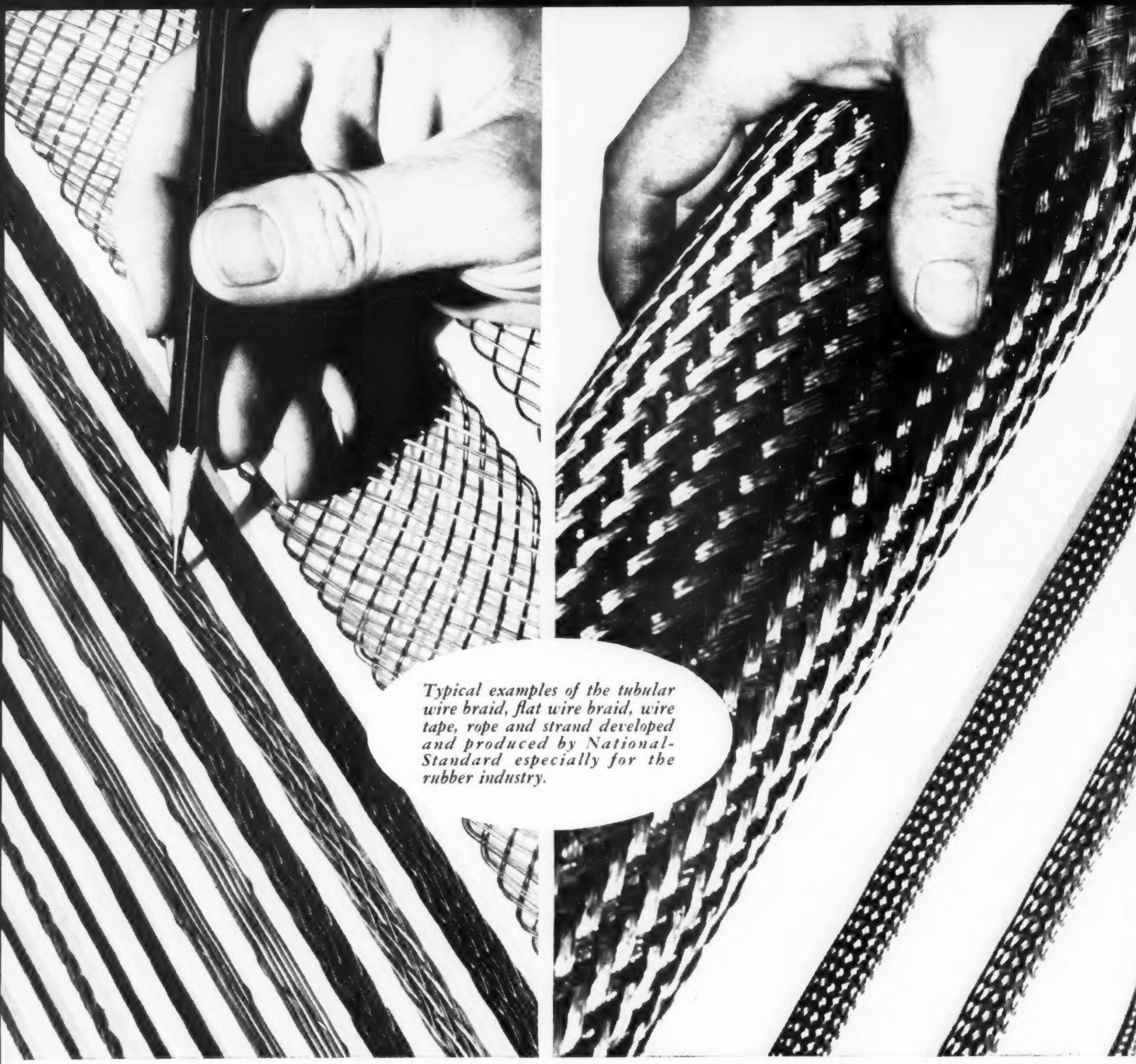

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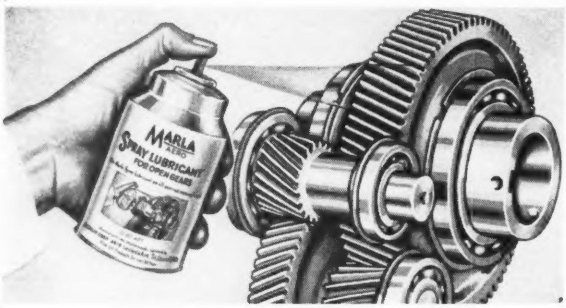

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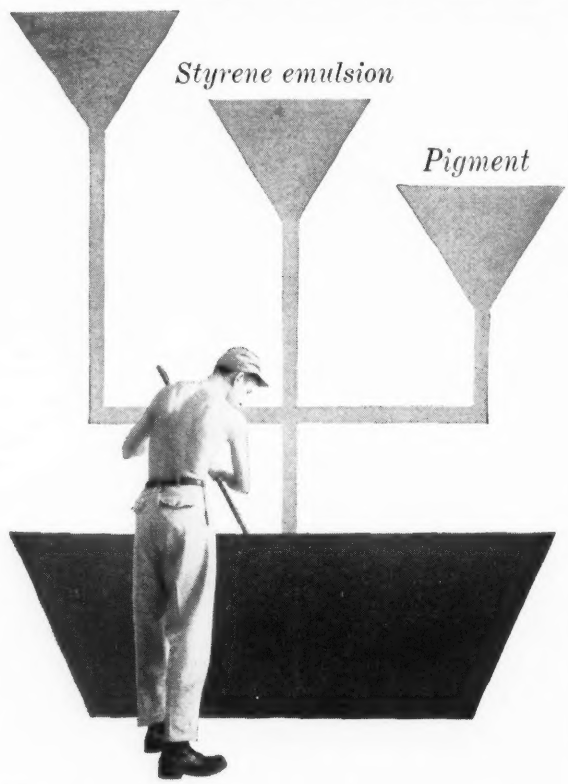

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RUBBER WORLD

SEPTEMBER, 1956

VOLUME 134, NUMBER 6

FEATURES

DEPARTMENTS

Cover photo, Columbian Carbon Co.

published monthly by
BILL BROTHERS PUBLISHING CORPORATION

editorial and executive offices
386 Fourth Avenue, New York 16, N. Y.
Chicago office
333 North Michigan Avenue
Midwest office
163 West Exchange Street, Akron 2, O.

RUBBER WORLD

SEPTEMBER, 1956

C. W. Sweitzer

G. L. Heller

The Formation of Carbon Black In Hydrocarbon Flames[1]

By C. W. SWEITZER and G. L. HELLER
Columbian Carbon Co., New York, N. Y.

The essential reaction common to all carbon black manufacturing processes is the thermal decomposition of hydrocarbon feed stocks to carbon. Investigation of the terminal products and reactions involved in this decomposition has provided evidence that the immediate precursor to the carbon black particle is a tiny oil droplet.

Based on these investigations, a theory of carbon black formation is derived which has been designated "The Oil Droplet Theory," which agrees broadly with the proposals of several previous investigators. This theory has proved of distinct value in orienting research and development thinking directed toward more efficient production of carbon black and more effective control of the properties of the final carbon product.

REGARDLESS of the particular flame process employed in the manufacture of carbon black, the basic reaction involved is the conversion of hydrocarbons by heat to form colloidally fine carbon. Many studies have been made on single hydrocarbon flames in an effort to unravel the complex reactions that occur in the formation of carbon. A mass of valuable experimental data has resulted from these investigations. Although the results and the theories based thereon are probably valid for the laboratory conditions employed, they appear to be of limited value for rationalizing the complex reactions involved during carbon formation in modern carbon black processes.

In order to develop a more valid picture of these formative steps in the manufacture of carbon black a series of investigations was carried out on the terminal reactions and products within the carbon black furnace. The findings indicated that carbon black formation most probably proceeds from an initial free-radical reaction, to the building of polycyclic aromatic compounds of increasing complexity which finally condense at furnace temperatures to liquid droplets, followed by pseudographitization to solid carbon particles.

In the present paper the prior theories on the formation mechanism are discussed. The experimental studies on the terminal reactions and products are described in some detail. Finally, on the basis of these investigations, the Oil Droplet Theory is proposed as the most plausible mechanism involved in carbon black formation from hydrocarbons in the present manufacturing processes.

Flame Processes

More than 90% of the total carbon black production in this country today comes from two flame processes, usually identified as impingement and furnace. In these processes the hydrocarbon burned may be natural gas or petroleum oil or mixtures of gas and oil.

[1]Based on a paper presented before the American Institute of Chemical Engineers, Houston, Tex., May 4, 1955.

The Authors

Carl W. Sweitzer, director of research and development, Columbian Carbon Co., received his bachelor's, master's, and doctor's degrees all from the University of Toronto, the last in 1927.

Dr. Sweitzer was a senior research fellow at the Mellon Institute of Industrial Research from 1927 until 1938. He joined Columbian Carbon in 1938 as chief chemist, became research director in 1951, and was promoted to his present position in 1955.

He is a member of the American Chemical Society and its Rubber Division, the Electrochemical Society, the Chemists Club of New York, and the Alumni Association of the University of Toronto.

George L. Heller, director of development for Columbian Carbon Co. at Monroe, La., received his chemical engineering degree from Rensselaer Polytechnic Institute in 1931 and his M.Ch.E. in 1933 from the same institution.

Mr. Heller was director of research for General Atlas Carbon Co. from 1933 to 1941. He joined Columbian Carbon in 1941 as director of development at Monroe, La., the position he now holds.

He is a member of the American Chemical Society, the American Institute of Chemical Engineers, and the Knights of Columbus.

The Impingement Channel Process

In the channel process millions of tiny flames, with characteristic shapes depending on the end-product desired, burning natural gas, in row upon row under the cover of a burning house, are made to impinge on moving channels and deposit their burden of carbon particles. If we look inside one of these burning houses, a view of the burning flames is obtained, as shown in Figure 1. The luminous portion of each flame is due to millions of incandescent carbon particles born within the flame, formed by decomposition of the gas through the action of heat developed in the outer sheath of blue flame. If uninterrupted, these particles would rise through the flame and be burned. If, however, a metal or other body cooler than the flame is inserted within it, the particles are interrupted in their flight and collect, layer upon layer, on this surface. By scraping this surface the carbon particles are recovered.

The non-luminous portion of the flame, from the burner tip to the edge of the luminous zone, is the region where the complex series of reactions leading from methane to the carbon particle takes place. The time interval involved is a fraction of a second. Sampling of this cracking zone for reaction products is possible with micro-techniques such as described by Smith and Gordon (1).[2] The larger furnace flames, however, are preferred in our laboratories for this type of investigation.

The Furnace Process

In contrast to the multiplicity of relatively small open flames in the channel process, the furnace processes develop relatively huge flames burning within a confined refractory chamber. In all furnace processes the carbon particles are released as an aerosol, which must then be separated from the hot gas stream. This separation process represents more than 90% of the structure in a furnace black plant, involving the successive steps of cooling, flocculation, and separation by cyclone separators and bag filters.

The furnace process permits wide variations in the design and operation of the reaction furnaces, most of which are patented. The separating and collection equipment is largely standard for all furnace plants, varying principally in capacity. These design and operation variations in the reaction furnaces will include such features as the shape and size of the chamber, the method of introducing the "make"[3] gas, the direction and velocity of the gas flow, and the method for developing the "blast"[3] gas. But whatever the variant in design and operation, the essence of all these processes involves the conversion of the make hydrocarbon by heat developed within the reaction chamber.

The walls of the reaction chamber may be broadly considered as the outer boundaries of the furnace flame. This confinement and the high gas velocities lengthen both the luminous and non-luminous portions

[2]Figures in parentheses refer to Bibliography items at end of this article.

[3]These are industry terms that will be used throughout the paper. "Make" refers to that portion of the total hydrocarbon introduced separately for "making" carbon. It is also known as feed stock, feed hydrocarbon, raw material, etc. "Blast" refers to that portion of the total hydrocarbon introduced separately for developing heat by combustion with air. It is also known as heat gas. Depending on the context, "make" and "blast" may also refer to the total gas streams associated with these separate phases. For example, "blast" may refer to the total combustion gas stream prior to contact with the "make" stream. When "make" and "blast" gas are combined as in free flame operations, the usual term applied is "total" gas or hydrocarbon.

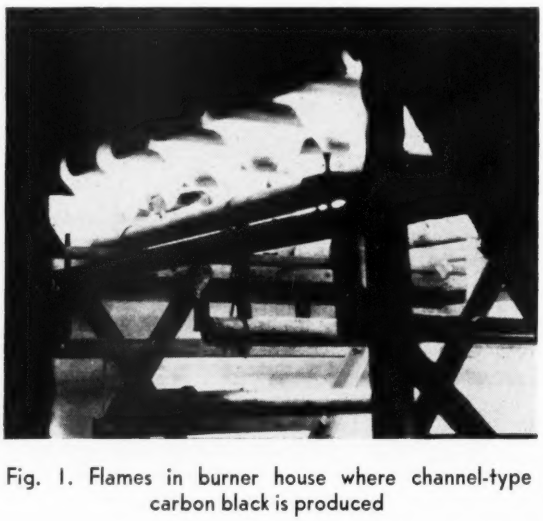


Fig. 1. Flames in burner house where channel-type carbon black is produced

of the flame reactions, thus permitting adequate zones for sampling. The schematic horizontal sectional view of a typical furnace flame in a rectangular furnace is shown in Figure 2. The heat gas is provided by a blast burner to the left (not shown), and the make gas is introduced through opposing side openings as shown. The non-luminous portion of the flame is indicated by boundary lines and extends from 12 to 18 inches downstream from the point of make entry. It is in this non-luminous portion of the flame where the complex reactions occur that lead to carbon particles, and it is within this zone that most of the investigations described in this paper were carried out.

In all furnace processes oxide products of combustion are present during carbon formation, and these oxides, whether under reducing or oxidizing conditions, have a marked effect on the final surface properties of the carbon. In any investigation of the mechanism of carbon formation the effect of these oxides must also be considered.

The Carbons

The varieties of carbons produced by these various processes are recognized as a group by their similarities, but are utilized in a thousand ways largely on the basis of their highly significant differences. These differences in properties (fineness, structure and surface chemistry, for example) are of greatest concern to the technologist, seeking answers to problems of specific application or end-use. But the similarities in properties provide answers to questions on the genesis of these carbon particles.

Properties in which carbon blacks show striking similarities include spheroidal shape, fineness in the colloidal range, identical internal structure by X-ray and chemical analysis, and the presence of oily extractable matter. The significance of these properties in developing a theory of the mechanism of formation is discussed in more detail in the succeeding section of the paper.

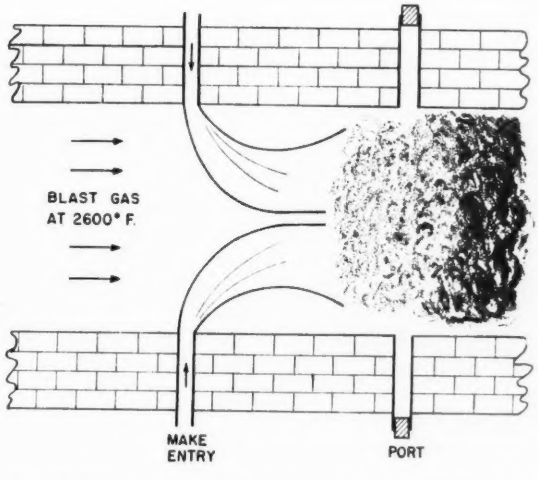


Fig. 2. Schematic sectional view of a furnace used for the production of furnace-type carbon-black, showing make gas pattern

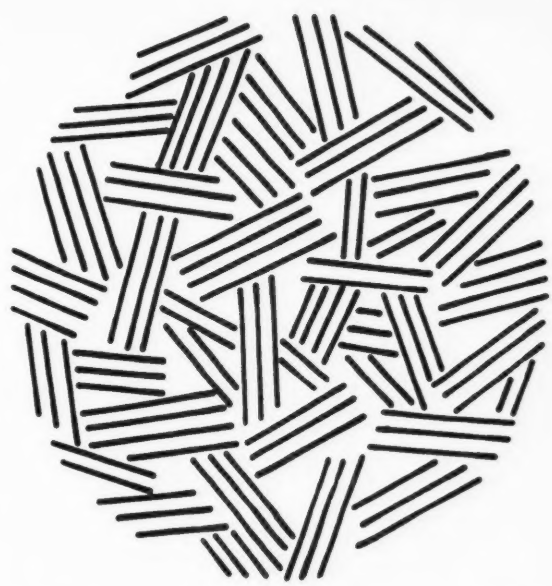


Fig. 3. Schematic representation of crystallites in carbon black particle

Mechanism Theories of Carbon Formation Based on Laboratory Flame Experiments

The complex reactions involved in the combustion and the thermal decomposition of gaseous hydrocarbons have been the subject of long and continuing investigations. From the large body of information on these reactions built up over the years a number of hypotheses concerning the mechanism of carbon formation have been postulated. None of these hypotheses are, however, universally accepted.

Even if any of the postulated mechanisms were fully accurate and complete for the experimental conditions employed, it is doubtful that such mechanisms would be valid for the reaction conditions found in carbon black furnaces. The essential carbon black-furnace conditions of time, temperature, and pressure have been only approximated in these laboratory experiments; raw materials that have been investigated are widely different from those used commercially; and, finally, the type of admixture of gas and air in a carbon black furnace is altogether different from any studied in these fundamental investigations. Thus these hypotheses are inadequate for direct use in the controlling of carbon operations. They are useful primarily in the planning of research investigations on commercial processes.

Initial Reactions

Early investigators were largely concerned with the initial decomposition reactions and products of methane. It was generally agreed that methane decomposes initially to free radicals which continue the reaction in some manner to form carbon. Some investigators postulated methylene radicals as the primary decomposition products; while others believed methyl radicals to be the initial product. The bulk of the experimental

evidence seems to favor the latter hypothesis, although energy considerations favor the former.

Kassel (2) and Belchetz and Rideal (3), employing different approaches, favored the formation of methylene radical as the initial step in methane decomposition. On the other hand, Rice and Dooley (4), Eltenton (5), and Robertson (6) favored the methyl (CH_3) radical as the primary reaction product, based on different experimental approaches.

C_2 Polymerization

The direct polymerization of C_2 radicals to carbon has been advanced as a possible mechanism in the formation of carbon based on the spectrographic study of stoichiometric flames. Gaydon and Wolfhard (7) and Smith (8) noted the dominance of C_2 bands in flame spectra under certain test conditions and suggested the probable formation of carbon from the polymerization of C_2 molecules. Parker and Wolfhard (9), on the other hand, regarded this C_2 polymerization mechanism as erroneous, based on their spectrographic observations from diffusion flames burning at reduced pressure.

Aromatic Molecule Condensation

The formation of carbon by the condensation of aromatic molecules was suggested by Rummel and Veh (10) in 1941. The proposed mechanism involved the splitting off of hydrogen atoms from each molecule, followed by combination of the aromatic residues and by the building up of the aromatic molecules by extending and closing of the side chains. The final product of these processes was postulated as a gaseous carbon skeleton which condensed to solid carbon as it reached a zone of lower temperature. Parker and Wolfhard (9) objected to this mechanism on the basis of spectrographic observations with diffusion flames burning at reduced pressure.

Hydrocarbon Droplet Condensation

Condensation of high molecular weight hydrocarbons to fine droplets, as a reaction mechanism for carbon formation in a diffusion flame, was proposed by Parker and Wolfhard. In this scheme hydrocarbons, not necessarily aromatic, of continually increasing molecular weight are formed by pyrolysis until the saturation vapor pressure is exceeded, when condensation to fine droplets occurs. These droplets contain graphite nuclei which grow and eliminate hydrogen from the droplet until the droplet is transformed into a carbon particle. The size of the crystallites depends on the number of graphitic nuclei originally present.

Graphitization of very large unstable hydrocarbon molecules was proposed as a second possible reaction mechanism by Parker and Wolfhard. According to this thesis, large unstable gaseous hydrocarbon molecules are formed which tend to decompose into their original material. Under favorable conditions very large molecules comparable in size to carbon particles are formed which graphitize when a region of sufficiently high temperature is encountered. Graphitization occurs by the same process as in the preceding mechanism.

C_2H_2 Condensation and Dehydrogenation

Simultaneous condensation and dehydrogenation of acetylene formed as an intermediate is the mechanism recently proposed by Porter (11), based primarily on flash photolysis experiments at temperatures well over 1000° C., with heating in the body of the gas rather than by the wall in order to reduce heterogeneous effects. The pyrolysis of hydrocarbons is postulated to follow a course which initially produces acetylene and hydrogen. Simultaneous dehydrogenation and condensation of the acetylene molecules then produces carbon particles. Aromatic intermediates were not identified in the experimental work and were ruled out as playing any part in the reaction.

A mechanism is written to show the growth of the carbon chain, the initiation of a conjugated structure, and finally the development of a ring structure, by the simultaneous addition of acetylene and removal of hydrogen. It is interesting that this theory brings the hypothetical wheel back full circle to the first comprehensive mechanism of carbon formation ever postulated. Berthelot in 1866 (12) stated that acetylene was "the ultimate product of hydrocarbon decomposition" and was "the fundamental generator of carbon formed by the action of heat or fire."

In summary, these various investigations and theories have contributed greatly to our understanding of the primary reactions occurring during the thermal and combustion decomposition of hydrocarbons and have been helpful in orienting our approach to the mechanism involved in carbon black manufacture. Their inadequacy is due to the employment of test conditions far removed from those present in commercial carbon black processes.

Major Terminal Reactions and Products in a Carbon Black Furnace

In our investigations, aimed at clarifying the course of these carbon forming reactions in the formation of carbon black, emphasis was placed on the composition of the carbon black product and the nature of the terminal reactions occurring in carbon black furnaces. It was felt that this type of information would provide a better basis for speculation on the genesis of carbon black particles than knowledge of the decomposition products, initial as well as intermediate, from controlled laboratory flame experiments.

Most of the furnace investigations were carried out on operations of the type described under Figure 2, where the make used was largely natural gas. Similar investigations on other types of furnaces, employing a variety of hydrocarbons, indicated that regardless of the hydrocarbon feed stock employed, the terminal reactions and products were similar. The conclusions reached regarding the terminal steps involved in carbon formation from hydrocarbon gas may therefore be considered as broadly applicable to all hydrocarbon feed stocks. Obviously the initial reaction steps would vary greatly with the feed stock which was used in the investigation.

Internal Structure of Carbon Black Particles

Based on X-ray diffraction measurements, it is generally agreed that the carbon black particle consists primarily of many small pseudographitic crystallites located randomly within the particle, somewhat as represented schematically in Figure 3. A certain percentage of amorphous or disordered material is present in the spaces between the crystallites. These crystallites consist of two to five parallel sheets of hexagonally packed carbon atoms in random orientation. This random orientation has been likened to the disarray of playing cards in a discarded hand, in contrast to the ordered orientation in an unopened deck of cards typifying true graphitic structure. In both cases strong covalent bonds bind the carbon atoms together in the two-dimensional sheet; whereas only the weaker molecular forces hold the parallel sheets together.

INTERNAL DIMENSIONS OF A CARBON BLACK PARTICLE

The Carbon Particle	
Diameter	200 Å (20mμ)
Molecular weight	5,000,000
Number of crystallites	1,500
The Crystallite	
Diameter (La)	17 Å
Thickness (Lc)	12 Å
Distance between planes (dn)	3.5 Å
Number of planes (Nc)	3.5
Molecular weight	3,000
Average size	3,000 Å^3
The Crystallite Plane	
Molecular weight	1,000
Carbon atoms	90
Hexagonal groups	35

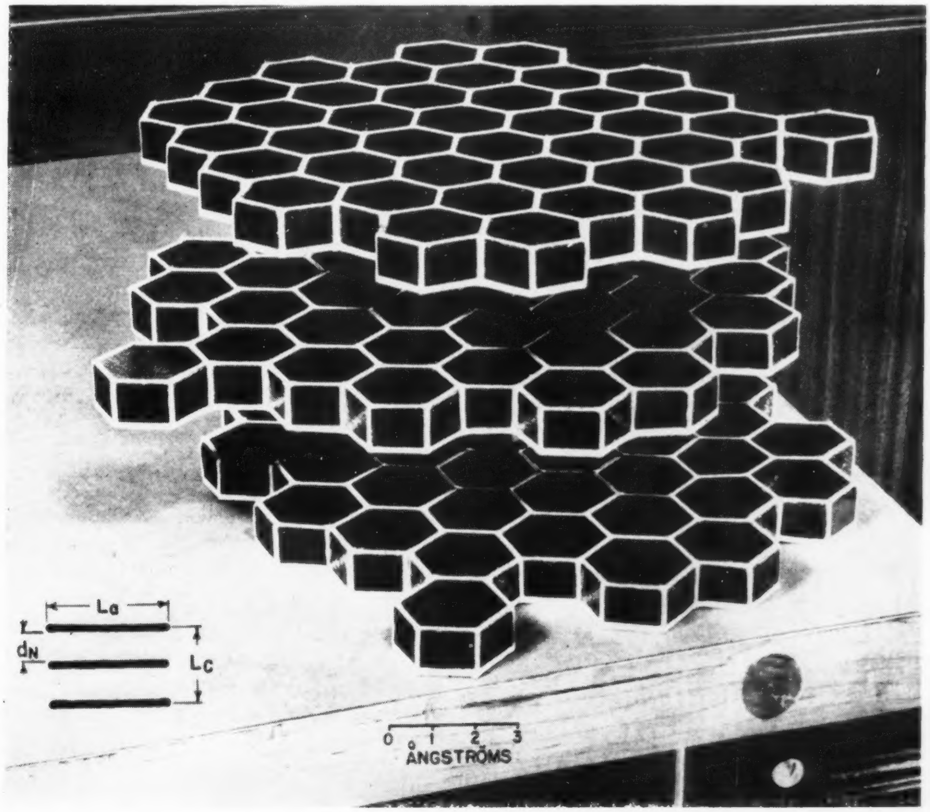


Fig. 4. Scale model of carbon black crystallite showing three parallel sheets of hexagonal groupings of carbon atoms

Measurements indicate an average crystallite to consist of three parallel sheets, randomly oriented to the vertical, with a diameter somewhat less than 20 Å, about as shown in the scale model photograph in Figure 4. In this model the hexagonal groupings of carbon atoms are represented by white lines. From these various measurements the following calculated average dimensions within a carbon particle of 20-millimicron (mμ) diameter are of interest.

All carbon blacks, regardless of process and feed stock, with the possible exception of acetylene black made by the Shawinigan process, exhibit crystallite development of the same general order of magnitude, suggesting that the genesis of all carbon blacks follows identical terminal paths. This similarity in crystalline development is demonstrated by the experimental data set forth in the table on the next page, with graphite included for comparison.

Of primary interest to the present investigation is the molecular structure of the individual planes in the

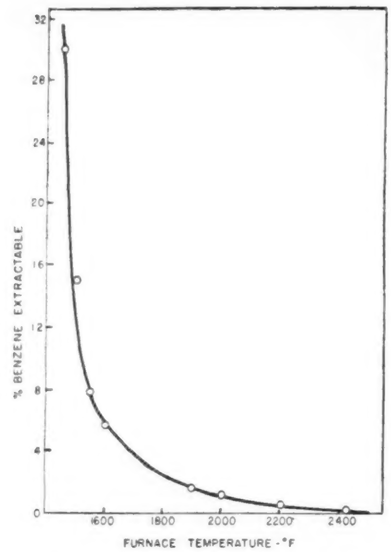


Fig. 5. Extractables vs. furnace temperature (contact time constant)

CRYSTALLITE DIMENSIONS OF CARBON BLACK

The Carbons		Crystallite Dimensions			
Type	Process	La (Å)	Lc (Å)	dn (Å)	Nc
Graphite	Natural	∞	∞	3.35	∞
Acetylene	Shawinigan	30.0	19.4	3.55	5.45
Micronex	Channel (gas)	17.0	12.3	3.56	3.46
Superba	Channel (gas)	14.0	11.5	3.56	3.23
Furnex	Furnace (gas)	20.0	14.0	3.58	3.91
Statex 125	Furnace (oil)	17.0	11.8	3.57	3.30
P-33	Thermal (gas)	21.0	14.9	3.57	4.19
Airmite	Lamp black (oil)	12.0	11.4	3.60	3.18

crystallite. These consist of hexagonal groupings of carbon atoms arranged in an order identical with that of condensed benzene rings. It seems quite probable that they formed by lateral growth from original simple aromatic structures. Continued growth of the crystallite to greater La and Lc dimensions was probably retarded by interference from adjacent random crystallites and by lack of sufficient temperature to develop more orientation.

Confirmation of this benzenoidal structure within the carbon particle is provided by the chemical oxidation studies of Juettner (13), carried out on various condensed ring structures and such carbonaceous materials as coal, coke, graphite, and carbon black. On the assumption that oxidation is exclusively peripheral, the yield of mellitic acid from the oxidation of condensed benzene-ring structures can be related to the molecular weight of the benzenoidal unit. The results for carbon black corresponded to calculated values based on the molecular weight of the average crystallite plane.

In summary, the evidence from X-ray analysis and chemical oxidation studies reveals that the condensed benzene-ring structure is the basic building unit within the carbon particle. It is the exposed edges of these condensed ring structures which most likely provide the active sites for terminal chemical groups on the carbon black surface, groups which play an important role in carbon-polymer interaction and which currently are under intensive investigation.

The Oily Matter Present on Carbon Black

The oily matter present on practically all carbon blacks, which can be extracted by benzene or acetone and is normally referred to as benzene or acetone extract, represents vestigial oil of the type involved in the growth and formation of the carbon particle. Normally, little, if any, of this oily matter is present on impingement carbons. On furnace blacks the percentage

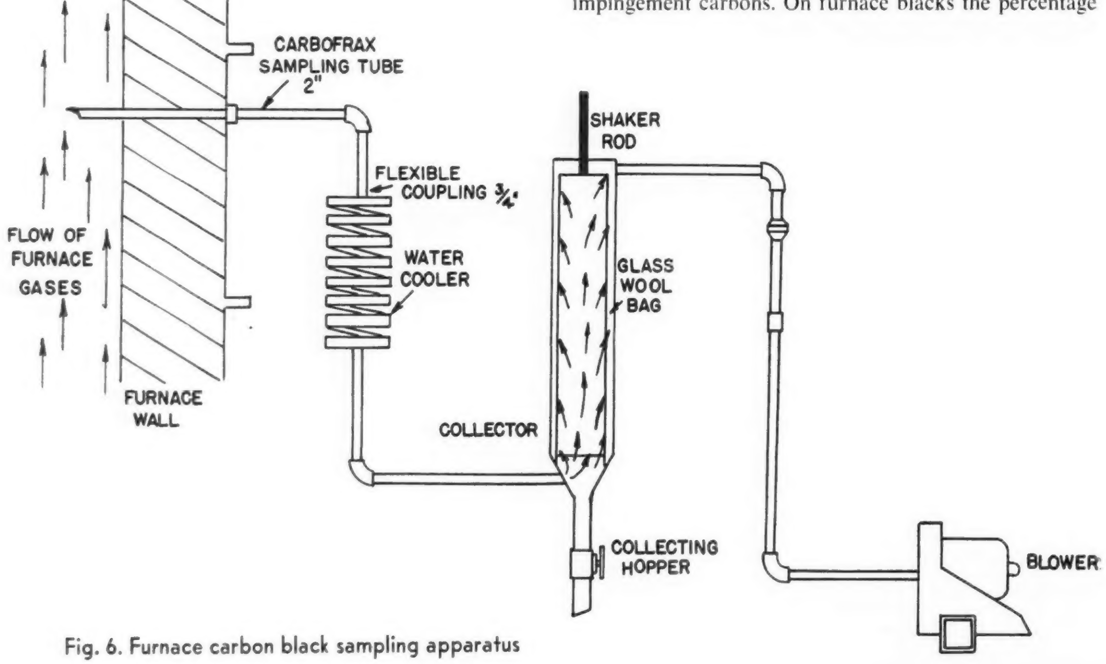


Fig. 6. Furnace carbon black sampling apparatus

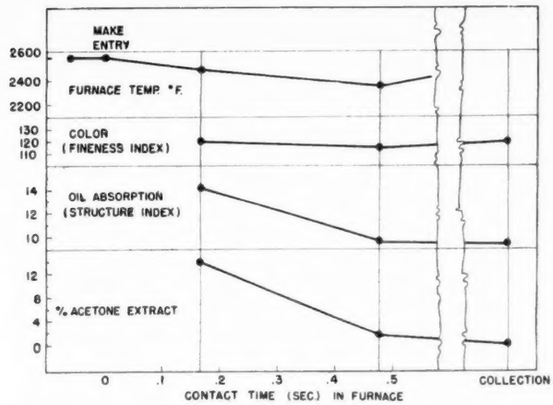


Fig. 7. Furnace temperature and properties of fine furnace carbon black from formation to collection

will range from trace to no greater than 0.2%. On thermal blacks and lamp blacks the percentage may exceed 1%. In normal operations the percentage of this extractable matter is held within minimum limits by control of temperatures and contact time. However, when operations are such that lower temperatures result, the percentage of this oily component may rise to as much as 30%, as shown in Figure 5.

That this oily matter actually precedes carbon formation in normal high-temperature furnace operations can be demonstrated by testing carbon samples withdrawn from the reaction zone, by means of a sampling apparatus such as shown in Figure 6. By employing this sampling technique throughout the reaction zone and at points downstream (see Figure 2), a series of carbon samples was obtained which gave the properties graphically presented in Figure 7. At the first sampling point in the reaction zone it is noted that the carbon is extremely oily although its particle size has already been largely determined.

Sampling at a point farther upstream gave only a dark viscous oily condensate in the apparatus. It would appear on the basis of this evidence that the immediate precursor to the solid carbon particle is a tiny droplet of oil. The possibility that a portion of these oily compounds was formed during sampling is recognized. Sampling under different time and temperature conditions, however, invariably gave these oily extracts, indicating that they were, in the main, furnace products.

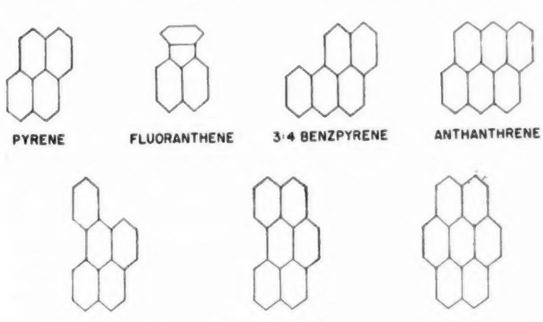


Fig. 8. Polycyclic aromatic hydrocarbons present in carbon black extract

Spectrographic analyses of these oily extracts revealed the dominance of various polycyclic compounds, the more common of which are shown in Figure 8. The fact that the seven-ring Coronene ($C_{24}H_{12}$) was the most complex polycyclic compound identified in this study does not preclude the probable existence of even more complex structures on the carbon surface, such as rhodacene ($C_{30}H_{16}$) and leucacene ($C_{54}H_{32}$) which were identified in previous studies. The similarity of these compounds to the larger structures comprising the crystallite planes is evident; the only difference is one of dimension.

In summary, the evidence from these studies on the oily matter associated with carbon black particles not only substantiates the conclusions reached from the X-ray investigations, but also provides additional background on the prenatal history of the carbon particle. It would appear that the basic building unit within the carbon particle, a high molecular weight condensed benzene-ring structure, is built up from simpler condensed ring structures which are present in the reaction zone in liquid, and probably droplet, form.

Pyrolysis

The progressive steps involved in the thermal decomposition or pyrolysis of hydrocarbon gas or vapor in an externally heated reaction tube provide further evidence on the probable mechanism of carbon black formation. The literature is replete with experimental data on these reactions, and it is generally agreed that the pyrolysis reaction proceeds by the successive, but overlapping steps shown in Figure 9, data for which were obtained in our laboratories.

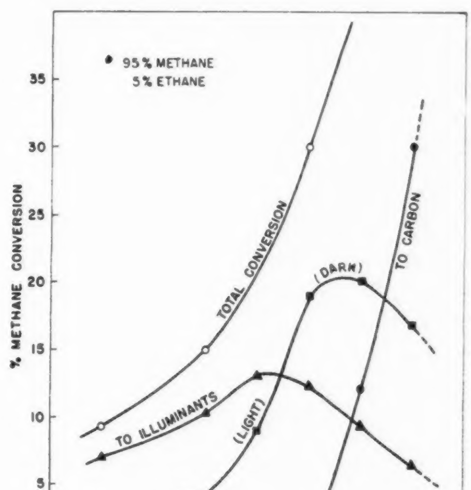


Fig. 9. Pyrolysis of methane (95% methane, 5% ethane) in one-inch silica tube at contact time of 1.5 seconds

Under the conditions employed in this study, that is, increasing temperature at approximately constant contact time, the methane gas began to decompose at a temperature somewhat below 800° C.; this conversion proceeded with increasing rapidity as the temperature was raised to 1100° C. The initial decomposition products were olefinic gases (acetylene and ethylene primarily), which reached a maximum at about 950° C. and then decreased as carbon was formed.

Shortly after the initial formation of these olefinic gases the development of a light fog was observed, which increased in concentration and darkness of color as the temperature was raised, reaching a maximum at about 1050° C., at which temperature carbon was forming rapidly. Analysis of this oil, removed from the gas stream by electrostatic precipitation, revealed aromatics ranging from benzene and naphthalene in the lighter fraction to highly condensed aromatics in the darker fraction. These condensed aromatics were broadly similar to those identified in the carbon black extracts.

At 1100° C., the major decomposition product was carbon, with the concentration of olefinic gases and aromatic oils decreasing rapidly. This fog formation would indicate that as these aromatic compounds become more complex, with corresponding lower vapor pressures, they condense out at the reaction tube temperature to tiny liquid droplets, prior to the formation of carbon particles.

Similar studies were carried out at a constant temperature of 2500° F., with smaller reaction tubes and contact times of the order of 0.02- to 0.05-second; these conditions of temperature and contact time approximate those in a furnace process. At the shortest contact time light oils as well as olefinic gases were identified. As the contact time was raised, the concentration of both increased; the olefinic gases reached a maximum at about 0.05-second contact time, and the oils at a somewhat longer contact time. Carbon formation was observed at a contact time of 0.05-second, thereafter increasing rapidly as the contact time was raised. Although the reaction rate in this instance was much more rapid than that given in Figure 9, it is noteworthy that the reaction mechanism followed a similar qualitative if not quantitative path.

It is concluded that in the thermal decomposition of hydrocarbon gas to carbon the reaction mechanism remains substantially constant under various reaction conditions although the relative amounts of the intermediate reaction products will vary. On the basis of these pyrolysis reactions, the mechanism of carbon formation would seem to involve the successive steps of methane decomposition to olefinic gases (probably by a free-radical reaction), the development from these olefinic gases of condensed aromatic compounds of increasing complexity which condense to a fog at the reaction temperatures, and the conversion of these condensed aromatics to carbon particles.

Carbon Structure

Investigations in our laboratory (14) have demonstrated that the development of the reticulate chain-structure property of carbon black is due to chemical fusion rather than physical attachment, with these fused linkages varying all the way from thin necks or rods to thick necks. The only plausible explanation for these linkages would seem to be one based on random collisions of oil droplets that precede carbon formation. As pointed out by Grisdale (15), in confirmation of this hypothesis, the dimensions of such necks will clearly depend on the fluidity of the droplets, being large when the fluidity is high, and small when they are more viscous. Undoubtedly the angle of collision would also be an important factor; glancing contact, for example, explaining the tangential rods observed in numerous electron photomicrographs.

There is the possibility that the hexagonal growth pattern of the crystallites within the particle itself might contribute to this structure development. Growth dominantly quinoidal might act as a mild polar attractive force between droplets. It does seem rather difficult to explain the development of these chain structures by any mechanism other than random collisions of liquid droplets.

Composition of Furnace Gases

The approximate course of the terminal oxidation and decomposition reactions involved in furnace processes has been followed by analysis of furnace gases withdrawn from various lateral and horizontal zones of the furnace. A satisfactory apparatus for gas sampling from the furnaces is shown in Figure 10. The Carbofrax or water-cooled stainless-steel withdrawal tube is inserted through port openings in the furnace wall, such as shown in Figure 2, and inched across the furnace to secure complete transverse sampling.

By employing this technique, typical composition patterns were obtained for the blast gas as well as the gases in the carbon reaction zone. The blast gas was found to be fairly uniform across the furnace, with the composition dependent on the air-to-gas ratio employed. In a typical blast flame, slightly oxidizing, the composition showed about 10% CO_2, 2% oxygen, less than 1% Co, with the balance N_2. It is these gases, in addition to the H_2O also present, at a developed temperature around 2600° F., into which the hydrocarbon make gas or oil is introduced for decomposition to carbon black. Heat transfer is rapid, by inspiration of the gases and by wall radiation. The relative rates of the ensuing and competing thermal decomposition and oxidation reactions then determine the efficiency of the process in terms of carbon end-product yield.

The course of these reactions at a point 12 inches below make entry is indicated by the typical analysis presented in Figure 11. In this particular instance sampling was carried out through the port shown in Figure 2, with conditions such that at this point the make streams had not as yet merged. From the results a picture of these rapidly moving reactions can be drawn. Since the make streams had not merged at this point, the blast gas had slipped through the center, as shown by the high CO_2 concentration in the middle zone.

In the two wall zones carbon formation is rapid

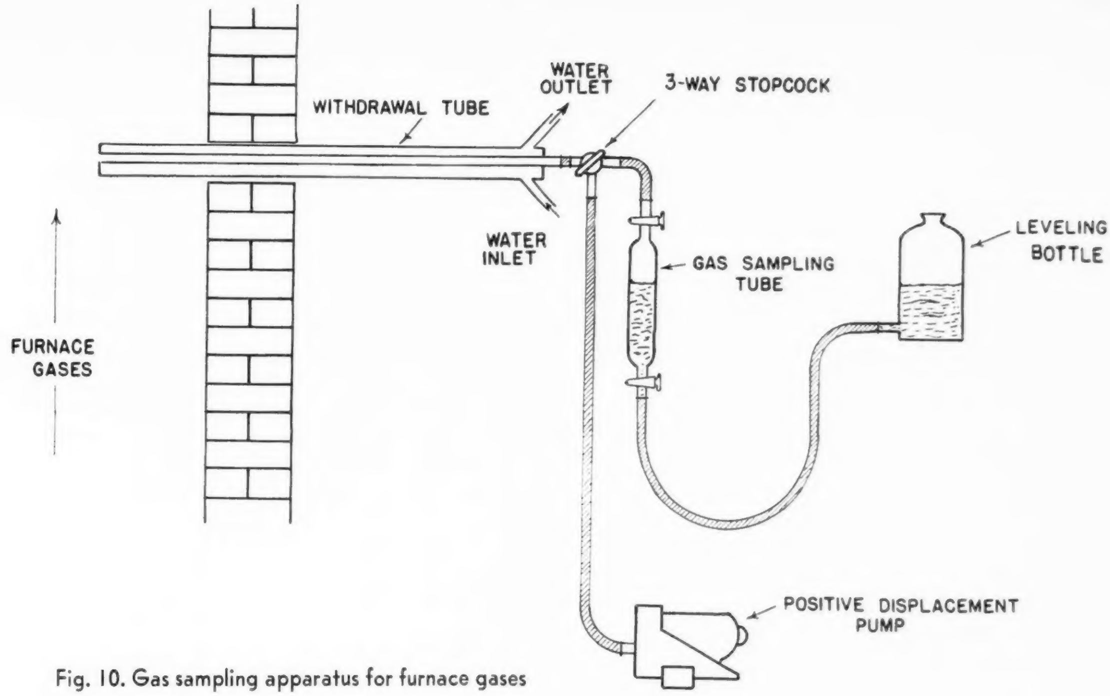


Fig. 10. Gas sampling apparatus for furnace gases

(not shown in graph), with the methane concentration decreasing, hydrogen increasing rapidly, and carbon monoxide increasing at the expense of carbon dioxide and either the hydrocarbon or carbon. The possible water gas reactions are not shown which develop carbon monoxide also at the expense of the hydrocarbon or carbon. Olefinic gases and light aromatic compounds were found to be present in minimum quantities, apparently representing intermediate products in the decomposition reaction.

In an effort to obtain a clearer picture of these oxidation reactions that lead to the loss of carbon, experiments were carried out in an externally heated reaction tube into which oxygen and the oxidized combustion products were added separately, and their effect on the hydrocarbon decomposition reaction was determined. Results showed that oxygen and water vapor were more reactive than CO_2 in depressing carbon yield, with the indication that they reacted preferentially with the initial decomposition products; whereas CO_2 reacted preferentially with the terminal oily products.

These studies have provided further evidence of intermediate olefinic and condensed aromatic stages involved in the thermal decomposition of hydrocarbon gas to carbon. These studies have also clarified to some extent the nature of the oxidation reactions that lead to carbon losses, thus suggesting possible means for improving efficiency, either by speeding up the rate of thermal decomposition or by depressing the oxidation reactions. The oxidation reactions occurring within the reaction or carbon-forming zone also control to a large extent the nature and the development of the terminal chemical groups on the carbon particle surface, which groups it is now recognized play a significant role in polymer-carbon black interaction.

The Oil Droplet Theory of Carbon Black Formation

These studies on the terminal reactions and products have provided a clearer picture of the probable reaction mechanism involved in the formation of carbon black from gaseous hydrocarbons. The X-ray and chemical oxidation studies have pointed to the basic chemical compound in the carbon particle as a multiple benzenoidal ring structure, consisting on the average of 35 condensed benzene rings; this unit comprises one plane in the pseudographitic crystallite. Analysis of the oily matter associated with many carbon blacks, and present in much larger quantity during the initial stages of carbon particle formation, has revealed this component to consist largely of multiple-ring aromatic compounds. These compounds, although smaller than the hexagonal structures in the crystallite plane, are nevertheless similar in their two-dimensional pattern. It appears probable that smaller polycyclic compounds of this general type constitute the nuclei within the particle which grow into the crystallite units.

Evidence based on the random crystallite arrangement within the carbon particle, on the oily character of the initial carbon particle, on the spherical shape of discrete carbon particles, on the development of carbon chain structure, on the progressive steps in pyrolysis which includes a heavy fog development that persists to carbon formation, and on the low vapor pressure for these multiple-ring compounds even at flame temperature, leads to the conclusion that the immediate precursor to the carbon particle in carbon black processes is a tiny oil droplet formed by the condensation of these high molecular weight polycyclic aromatic compounds.

The evidence is not quite so clear on the formation

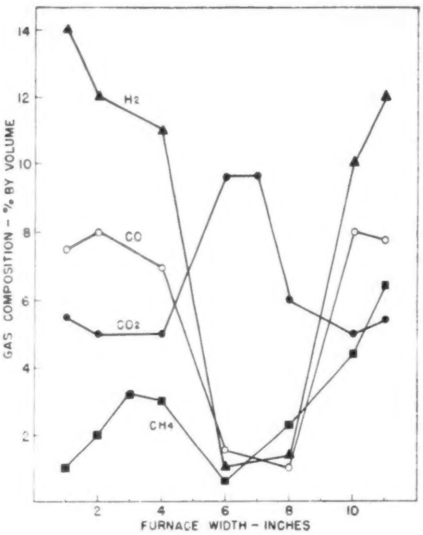


Fig. 11. Typical transverse gas analysis; make streams not merged; oxygen and illuminating gas below 1%

and growth of these initial ring compounds. The pyrolysis studies as well as the gas analyses do point to the early presence of olefinic gases, such as acetylene and ethylene, and it seems likely that they constitute the building blocks for benzene and other simple ring compounds that precede the formation of the polycyclic aromatic structures.

Combining these conclusions from the studies on terminal products and reactions, with the pertinent findings and conclusions of other investigators on the initial products and reactions, the following mechanism of carbon formation from natural gas is proposed as being most applicable to actual carbon black experience, viz.:

Acetylene and probably ethylene are formed first by one of the free radical reactions postulated earlier; by a combination of chain growth, dehydrogenation and condensation of these olefinic compounds, simple benzene ring structures are formed; these simple ring compounds grow in a two-dimensional plane to more complex structures, either through a side chain growth or by direct combination of aromatic residues resulting from dehydrogenation; the high molecular weight benzenoidal structures condense to fine oil droplets as the saturation vapor pressure is exceeded; these oil droplets on further dehydrogenation graphitize or crystallize from crystallite nuclei to solid carbon particles. A simplified chart of this mechanism is presented in Figure 12.

Discussion

In the manufacture of carbon black two basic factors dominate the various processes. These are: (1) the ratio of oxidation to thermal decomposition, and (2) temperature. In thermal carbon processes, as well as in pyrolysis, the thermal decomposition reaction operates exclusively since the heat is supplied from an external source. Depending on the temperature, the reaction can be carried either to completion (carbon) or short of completion (intermediate products). In this type of process, at the temperature levels normally employed, the mechanism of carbon formation unquestionably involves the terminal steps shown in Figure 12. In all flame processes, impingement as well as furnace, the heat required for the thermal decomposition reaction is supplied by combustion of a portion of the hydrocarbon gas. In these processes it is very important to maintain the proper balance between the oxidation reactions and the thermal decomposition reactions, if efficient yields of quality carbon black are to be obtained. Normally the flames are designed insofar as practical to provide for the maximum of thermal decomposition with the minimum of oxidation. The major reaction involved in the actual formation of carbon black remains, however, the thermal decomposition reaction. The mechanism of this reaction remains substantially similar to that involved in the straight thermal processes, since temperature levels are approximately equivalent.

In diffusion flames and related laboratory methods the conditions are quite different from those present in the carbon black flame. These differences, in temperature and oxidation conditions particularly, probably account for the variable results reported by earlier investigators. It is quite possible, for example, that at higher temperature levels than those actually involved during carbon black formation the mechanism of Porter (11) does operate.

It is evident from theoretical considerations, confirmed by laboratory and plant experience, that in the decomposition of methane the energy required to start the initial free radical reaction is much greater than that required for the higher homologs in the methane series. In the case of unsaturated hydrocarbon gases this energy requirement is still less and becomes increasingly less as the hydrocarbon progresses through the aromatic types. Hence when economic factors permit, it has been found practical to substitute feed stocks of those more reactive types in carbon black operations. The recent trend to residue oil feed stocks is an example of such substitution. These higher molecular weight feed stocks follow the terminal steps in the mechanism presented in Figure 12.

It was pointed out that in furnace operations there are two competing reactions for the carbon in the hydrocarbon, the thermal decomposition reaction leading to carbon and the oxidation reactions leading to carbon monoxide and hence loss of carbon. There are a number of possible approaches suggested by the "Oil Droplet Theory" for attacking this serious problem. Possibly the most direct application of this theory is in the planning and direction of research programs directed to the more efficient production of carbon black and to more effective control of the properties in the final carbon product.

Summary

Regardless of the variety of carbon black manufacturing processes in operation today, the essential reac-

tion common to all processes is the thermal decomposition of hydrocarbon feed stocks to carbon.

Investigation of the terminal products and reactions, involved in this decomposition sequence of events, has provided evidence that the immediate precursor to the carbon particle is a tiny oil droplet. This droplet, it would appear, forms by the condensation of high molecular weight polycyclic benzenoidal compounds, which are built up by a sequence of reactions starting with initially formed acetylene and ethylene. Within each droplet oriented polycyclic compounds act as nuclei in the development of pseudographitic crystallites which comprise about 90% of the carbon particle weight.

Based on these investigations, a theory of carbon black formation is derived which has been designated "The Oil Droplet Theory." This theory agrees broadly with the proposal of several previous investigators.

This theory has proved of distinct value in orienting research and development thinking on theoretical and production problems concerned with carbon black manufacture.

In the impingement and furnace processes oxidation reactions occur simultaneously with the decomposition reactions and in varying degree convert potential carbon to carbon monoxide; this conversion represents a direct loss of carbon black. These oxidation reactions are largely responsible for the presence of the chemical terminal groups on the carbon black surface, which play a significant role in carbon black-polymer interactions.

Despite this similarity between carbon blacks in their genesis and internal structure, it is recalled that their differences in particle size, anisotropy, and surface chemistry largely determine their specific application and end-use.

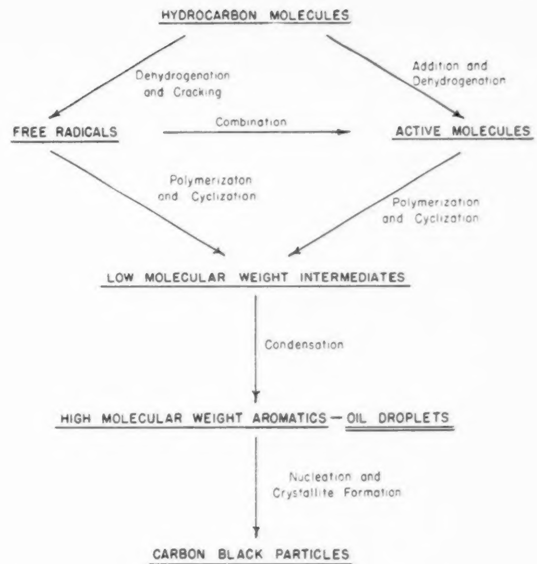


Fig. 12. Probable mechanism of carbon black formation

Acknowledgment

Grateful acknowledgment is made to K. A. Burgess for assistance on the theoretical section of the paper, to various members of the research and development departments for assistance on the experimental work, and to A. Harvitt, vice president of Columbian Carbon Co., for permission to publish this paper.

Bibliography

(1) *J. Chem. Phys.*, 22, 1150 (1954).
(2) *J. Am. Chem. Soc.*, 54, 3949 (1932).
(3) *Ibid.*, 57, 1168 (1935).
(4) *Ibid.*, 56, 2747 (1934).
(5) *J. Chem. Phys.*, 10, 403 (1942); 15, 455 (1947).
(6) *Proc. Roy. Soc. (London)*, A199, 394 (1949).
(7) *Trans. Faraday Soc.*, Disc. #2, 161 (1947).
(8) *Proc. Roy. Soc. (London)*, A174, 122 (1940).
(9) *J. Chem. Soc.*, Aug., 1950, p. 2038.
(10) *Arch. Eisenhüttenw.*, 10, 489 (1941).
(11) "Fourth Symposium (International) on Combustion," p. 248. Williams & Wilkins, Baltimore (1953).
(12) *Comp. rend.* LXII, 005, 947 (1866).
(13) *J. Am. Chem. Soc.*, 59, 1472 (1937).
(14) Ladd and Wiegand, *Rubber Age (N. Y.)*, 57, 299 (1945).
(15) *J. Applied Phys.*, 24, 1090 (1953).

Carbon Black in Silicone Rubber

Silicone rubber has been successfully reinforced with carbon black, according to a report of recent research for the Air Force released to industry through the Office of Technical Services, United States Department of Commerce.

The research was done by A. J. DeFrancesco, Connecticut Hard Rubber Co.,[1] for Wright Air Development Center. Until now, only hydrocarbon rubbers have been successfully reinforced with carbon black.

During tests on a new silicone polymer, Linde W-96, a dimethyl siloxane modified with a small number of active vinyl groups on the side chains, carbon black was introduced as a filler after the gum had been vulcanized with di-tertiary-butyl peroxide. A firm, well-reinforced rubber was produced, the Department of Commerce reveals.

Previous attempts at incorporating carbon black fillers in silicone rubber had not been too successful. The carbon black hampered the curing action, evolved gas at high temperatures, and generally provided poor reinforcement.

It had been found that only the so-called white fillers produced satisfactory reinforcement. These include silica, calcium carbonate, and titanium dioxide.

Mr. De Francesco's report is entitled, "Reinforcement of Silicone Rubber with Carbon Black." It may be ordered from the OTS, United States Department of Commerce, Washington 25, D. C. The 33-page report costs $1. It was published in February.

[1] See article beginning on next page.

Compounding of Silicone Rubber—IV

Testing of Silicone Rubber at Elevated Temperatures[1]

By ALDO J. DeFRANCESCO, ROGER D. ALLING, and JOHN H. BALDRIGE
Connecticut Hard Rubber Co., New Haven, Conn.

An apparatus for measuring the physical properties of rubber compounds at elevated temperatures has been designed and constructed.

The tensile strength, elongation, and tear strength of silicone rubber compounds were determined at temperatures from about 75 to 400° F. These properties decrease markedly at 400° F. except for certain compounds containing an organo-coated silica pigment where values from 1½ to 4 times those of compounds reinforced with other fillers were obtained.

Tests conducted on rubber compounds designed for high-temperature service should be made at the service temperature.

THERE are many applications for rubber at elevated temperatures. For example, in this new era of supersonic flight, rubber items will soon be required to perform at temperatures of 300° to 500° F., and, possibly in the near future, as high as 1000° F. Rubber is in a fairly static state in many applications, but there are probably just as many occasions when rubber is strained close to the breaking point. Over the years the well-known artificial aging tests have been developed, in which the rubbers are subjected to a high temperature for various periods of time in air or oxygen. After such aging, the rubbers are examined for tensile strength, elongation, and tear strength, but the measurements are usually made at room temperature.

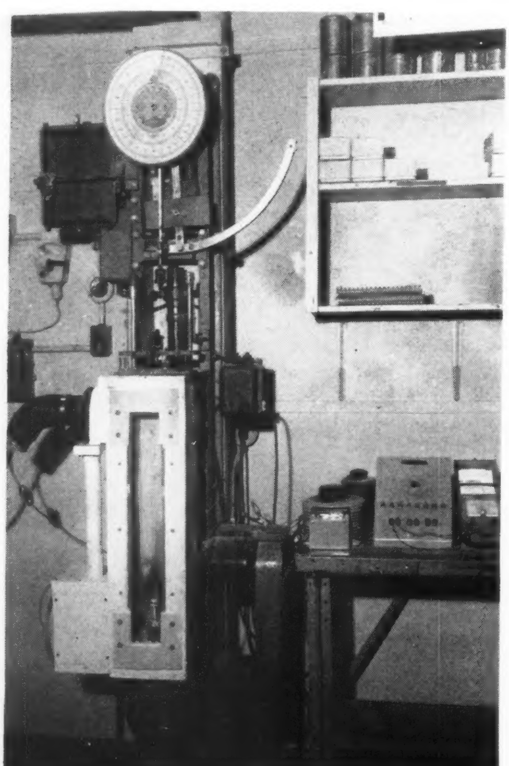


Fig. 1. Scott tester, Model L6, equipped with special Marinite chamber for testing at above room temperature

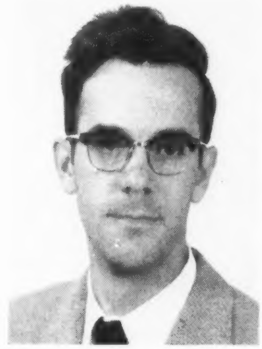
More information concerning the performance of rubber at elevated temperatures is necessary. It is of special interest to know the properties at elevated temperatures of silicone rubber, which, having definitely superior aging resistance, is used extensively under high-temperature conditions. It was the purpose of this work to build a test apparatus in which the tensile strength, elongation, and tear strength of various rubber compounds could be measured at elevated temperatures. Emphasis was placed on simplicity of construction and validity of comparative test results.

Design of the High-Temperature Test Apparatus

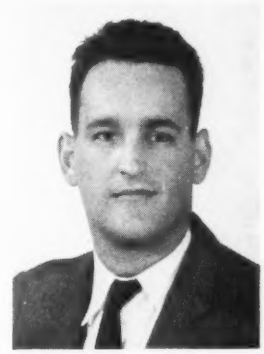
The test apparatus consisted of a chamber made of Marinite[2] which was fitted to the front of a Scott tester, Model L6,[3] as shown in Figure 1. A permanent framework for the apparatus was attached to the machine. The heated test chamber and the pulley system were designed as removable equipment; time and ease of assembly and disassembly were important factors.

[1] Presented before the Division of Rubber Chemistry, ACS, Philadelphia, Pa., Nov. 2, 1955. Previous papers in this series were published as follows: I, India RUBBER WORLD, 128, 766 (1953); II, *Ind. Eng. Chem.*, 45, 1297 (1953); III, RUBBER WORLD, 132, 193 (1955).
[2] Johns-Manville Corp., New York, N. Y.
[3] Scott Testers, Inc., Providence, R. I.

Aldo J. De Francesco



Roger D. Alling



John H. Baldrige

The Authors

Aldo J. De Francesco, sales engineer, The Connecticut Hard Rubber Co., received his bachelor's and master's degrees in chemistry from the University of Connecticut, the latter in 1951. He was a research associate at Yale University in 1951-52, before joining Connecticut Hard Rubber in 1952, as a chemist. He was made a group leader in the research and development department of the company before becoming a sales engineer.

Mr. De Francesco is a member of the American Chemical Society and its Rubber Division, the Connecticut Rubber Group, Phi Lambda Upsilon, and the Knights of Columbus.

Roger D. Alling received his B.S. degree in physics from Yale University in 1950. He spent 1950 to 1953 in the U. S. Navy before joining Connecticut Hard Rubber in 1953.

Mr. Alling is a member of the American Physical Society and the Connecticut Rubber Group.

John H. Baldrige obtained his B.S. degree from Juniata College and his M.S. from Yale University in 1955. In 1952-53 he was an analytical chemist at Massachusetts Institute of Technology. He joined Connecticut Hard Rubber in 1955 after receiving his master's degree.

Mr. Baldrige is a member of the ACS.

The heating system was planned to provide heat by forced air and by convection. Most of the heat was obtained with the Nichrome coil heater mounted outside the chamber. The heat was circulated by an air-cooled exhaust fan which pulled the air through the outside heater and into the bottom of the chamber. The air was deflected at the orifice into the chamber to prevent a direct blast of hot air on the sample.

The second heater is shown in the detailed diagram (Figure 2) of the test apparatus. This heater consisted of resistance-wire, wrapped around a strip of Transite.[2] Another strip of Transite was placed beside the heater to encourage convection heating and to eliminate any radiation effect. Heating was controlled by varying the voltage applied to each heater. The temperature was measured throughout the entire chamber by a series of thermocouples connected to a pyrometer.

The pulley system of the test apparatus was designed for attachment to the Scott tester so that the force could be read from the dial of the latter. The diagram shows the "Z" clamps which held the test sample. The lower "Z" clamp was fixed. The upper one was attached, by means of a braided, stainless steel wire operating through a system of frictionless pulleys, to the unmodified portion of the Scott tester. Because of the 180-degree change in direction in the pulley system, the dial reading indicated twice the actual force.

Also pictured in the diagram are the indicators used for measuring the elongation of the rubber sample. These indicators rode on spring-loaded wire which could be easily moved by pulleys. On the wire to which the lower indicator was attached, there were

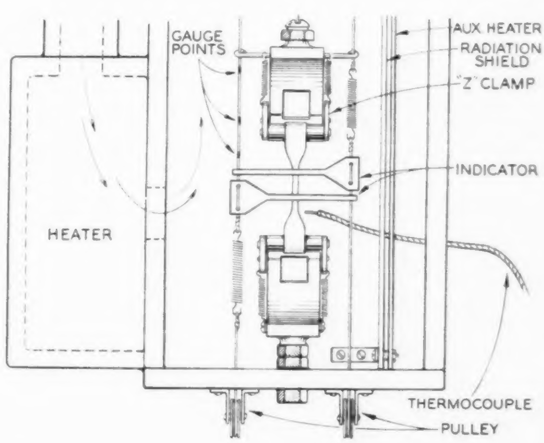


Fig. 2. Detailed drawing of high-temperature testing apparatus showing chamber, heaters, thermocouples, and clamps for test sample

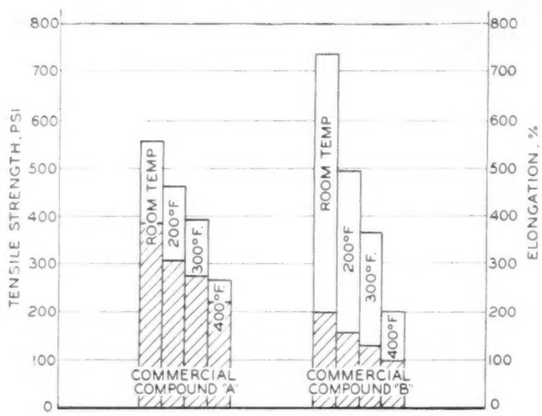


Fig. 3. Properties of commercial silicone rubber compounds at elevated temperatures

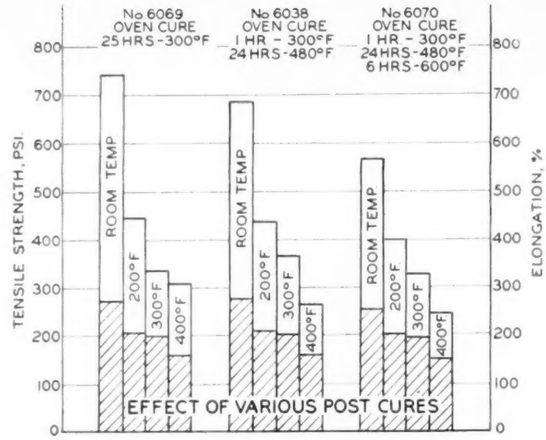


Fig. 4. Effect of various postcure temperatures on tensile strength of silicone rubber at elevated temperatures

three beads of silicone resin which served as gage points for measuring the stress at a specific elongation. Readings could be taken manually or could be recorded electrically on the Scott tester.

Calibration of the High-Temperature Test Apparatus

In order to determine the accuracy of measurements in the new apparatus, the physical properties of several silicone rubber compounds were determined on the unmodified Scott tester and in the test apparatus at room temperature, as shown in Table 1. Tensile strength and elongation were measured according to ASTM Specification D412-49T,[4] and the median of three values is reported at all times. It was found that the physical properties measured in the test apparatus were usually greater than those measured on the unmodified Scott tester. This positive difference indicated that an additional force must be present, most likely caused by some friction in the pulley system. Friction could be caused (1) by the wire rubbing on the pulley wheels, (2) by the wire being slightly out of line, or (3) by rubbing of the wire at the aperture of the box. The average deviation between the two methods of measurement was calculated for tensile strength and elongation: they were 9.1 and 4.8%, respectively.

TABLE 1. CALIBRATION OF THE TEST APPARATUS

	Tensile Strength, Psi.			Elongation, %		
Compound No.	Scott Tester	Test Apparatus	% Deviation	Scott Tester	Test Apparatus	% Deviation
6038	626	692	+10.6	275	285	+ 2.5
6039	800	865	+ 8.1	250	245	— 2.0
6040	765	834	+ 9.0	225	250	+11.0
6041	484	557	+15.2	375	390	+ 4.0
6042	745	735	— 1.3	195	200	+ 2.6
6069	655	746	+13.9	275	280	+ 1.8
6070	491	565	+15.2	260	260	0
6071	760	805	+ 5.9	125	150	+20.0
6076	671	650	— 3.1	230	240	+ 4.3
6077	671	731	+ 9.0	205	205	0
Average deviation			9.1			4.8

It was felt that the agreement between the two methods was satisfactory enough to warrant the use of the test apparatus in making comparative measurements at various temperatures.

Effect of Soak Time at Test Temperature

In order to be sure that only the direct effect of temperature was measured, and not the effect of aging, silicone rubber samples of the same composition were conditioned for various lengths of time at 300° F. The test temperature of 300° F. was normally achieved in 15 to 30 seconds after the test chamber had been closed. It took another 10 to 15 seconds for the test samples to reach 300° F. After reaching 300° F., the samples were soaked for 0, ½, 1, 2, 4, and 8 minutes before being tested.

Each result in Table 2 is the median value of three test samples. The results are within 10% of each other; this variation was expected in different sheets of the same compound, being tested at this temperature. There seems to be no definite trend displayed by this series of samples, which point indicates that equilibrium of the silicone rubber samples was attained immediately after reaching 300° F. To insure equilibrium, all future test samples were tested two minutes after reaching the required test temperature.

TABLE 2. EFFECT OF SOAK TIME AT TEST TEMPERATURE 300° F.

Time after Reaching Temperature, Minutes	Tensile Strength, Psi.	Elongation, %
0	481	160
½	493	180
1	524	170
2	488	140
4	491	140
8	526	160

In conjunction with a government contract issued by Wright Air Development Center[5] [Contract No. AF

[4] American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.
[5] Wright-Patterson Air Force Base, Dayton, O.

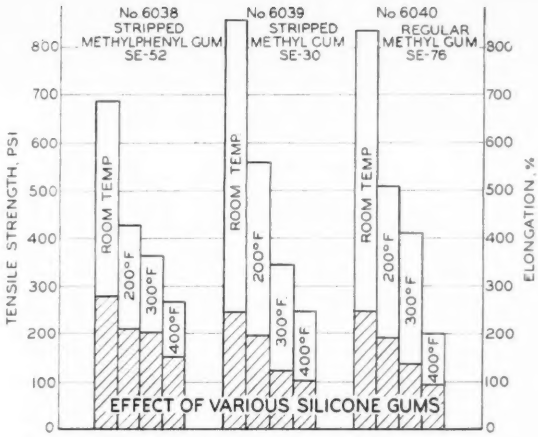


Fig. 5. Effect of various silicone rubber types on physical properties of the compounds at elevated temperatures

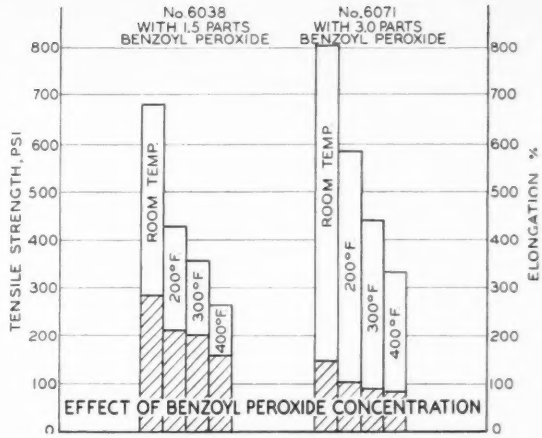


Fig. 6. Effect of benzoyl peroxide concentration on physical properties of silicone rubber at elevated temperatures

33(616)-2542], work was done early in 1955 at The Connecticut Hard Rubber Co. on the testing of silicone rubber compounds at high temperature. The tensile strength, elongation, and tear strength of many commercially available compounds were determined at room temperature, 212 and 400° F., and it was found that these properties were greatly reduced when measured at high temperatures. At 400° F. the % decrease for tensile strength ranged from 54 to 68; for elongation, from 40 to 64; for tear strength, from 43 to 80.

Tests on two of the commercial compounds, reputed to have excellent stability at extremely high temperatures were repeated at room temperature, 200, 300, and 400° F. The results of these tests are shown in Figure 3. At 400° F. the tensile strengths of A and B are 270 and 200 psi., which represent a decrease in tensile strength of 52 and 83%, respectively; the elongations are 220 and 100%, a decrease of 44 and 50%, respectively. Since both of these compounds had been postcured for one hour at 300° F., followed by 24 hours at 480° F., they were well conditioned for service at the test temperatures.

Properties of Various Silicone Rubber Compounds at Elevated Temperatures

In view of the poor properties exhibited by silicone rubber at elevated temperatures, an effort was made to determine the extent to which this characteristic could be improved by proper compounding.

The first experiment was concerned with a study of the effect of postcure on high-temperature properties. A typical silicone compound was mixed and vulcanized having the following formulation:

	Parts
SE-52* (methylphenylsiloxane)	100.0
Hi-Sil X-303†	50.0
Benzoyl peroxide	1.5

Press cure: 15 minutes at 250° F.

* General Electric Co., silicone products department, Waterford, N. Y.
† Columbia-Southern Chemical Corp., Pittsburgh, Pa.

This compound was given three different postcures: (1) 25 hours at 300° F.—Compound No. 6069; (2) one hour at 300° F. and 24 hours at 480° F.—Compound No. 6038; and (3) one hour at 300° F., 24 hours at 480° F., and six hours at 600° F.—Compound No. 6070. As shown in Figure 4, it was found that the higher the postcure temperature, the less the % decrease in tensile strength at the high temperatures. The differences in the % decrease at 400° F., however, were small, so that the higher the tensile strength at room temperature (obtained with a postcure of 300° F.), the higher the tensile strength at 400° F. Elongations of the three samples were approximately the same at elevated temperatures.

In order to determine the effect of the type of silicone gum on high-temperature properties, three different gums were investigated. The types of gum were: (1) SE-52, a methylphenylsiloxane stripped of low-molecular-weight material—Compound No. 6038; (2) SE-30, a methylsiloxane stripped of low-molecular-weight material—Compound No. 6039; and (3) SE-76, a standard methylsiloxane—Compound No. 6040. The formulation used for this experiment was:

	Parts
Silicone gum	100.0
Hi-Sil X-303	50.0
Benzoyl peroxide	1.5

Press cure: 15 minutes at 250° F.
Postcure: one hour at 300° F., 24 hours at 480° F.

As demonstrated in Figure 5, the methylsiloxanes, especially the stripped gum, displayed the best room-temperature reinforcement in this formulation. As the temperature was increased, however, the methylphenylsiloxane showed the least % decrease in properties, as well as slightly higher tensile strength and elongation at 400° F.

The next experiment was a study of the effect of the concentration of benzoyl peroxide. Compound No. 6038, containing 1.5 parts benzoyl peroxide, and Com-

pound No. 6071. of similar composition, but containing three parts of benzoyl peroxide, were compared. As expected, it was found that the compound with the greater amount of benzoyl peroxide had higher tensile strength, but lower elongation, not only at room temperature, but also at elevated temperatures, as shown in Figure 6. The % decrease in tensile strength and elongation for both compounds at 400° F. was approximately the same. Neither of the two compounds appears to be superior to the other, although it is customary to select the material containing less peroxide and possessing the highest elongation, in order to obtain better compression set and aging properties.

Small amounts of iron oxide are often added to silicone rubber compounds to increase their stability at high temperatures. Two parts of iron oxide were added to a methylphenylsiloxane, Compound No. 6076, and to a methylsiloxane, Compound No. 6077. The cures and formulations of these two compounds, except for the added iron oxide, are the same as those of Compound Nos. 6038 and 6039. As shown in Figure 7, the addition of iron oxide lowered room-temperature properties, and, in general, also seemed to cause slightly poorer properties at elevated temperatures. This lack of improvement indicates that any benefit obtained from small amounts of iron oxide during aging at high temperatures possibly can be attributed to reduced oxidative degradation which occurs slowly in silicone rubber at 500 to 600° F.

In the next experiment glass wool was used as an additional filler. It was believed that the glass fibers would tend to hold the silicone rubber compound together at high temperatures. Five and ten parts of glass wool were added to compounds of the same composition as that of Compound No. 6038. The tensile strength and elongation values in Table 3 demonstrate the effect of added glass wool. The addition of either five or ten parts of glass wool results in much poorer properties at high temperatures. Tear strength is only slightly improved in the compounds containing glass wool.

Tear Strength of Various Silicone Rubbers at Elevated Temperatures

The tear strengths[6] of all of the previously mentioned compounds were measured, at room temperature, 200, 300, and 400° F. It is well known that the tear strength of most silicone rubbers at room temperature is not so great as the tear strength of the hydrocarbon rubbers which are usually reinforced with carbon black. The tear strength of the silicone compounds reported in this paper are given in Table 4. All of the compounds, which included two commercial materials (Nos. 6041 and 6042), have tear strengths at room temperature ranging from 37 to 101 pounds per inch. The results also show that hot tear tests fall off just as do elongation and tensile; the values at 400° F. range from 10 to 40 pounds per inch.

TABLE 4. TEAR STRENGTH OF SILICONE RUBBERS AT ELEVATED TEMPERATURES

Compound No.	Tear Strength, Lbs./In. Room Temperature	200° F.	300° F.	400° F.
6038	71	56	34	35
6039	55	34	23	17
6040	55	34	22	20
6041	101	62	34	23
6042	39	26	16	10
6069	76	48	38	28
6070	55	47	41	27
6071	37	41	22	16
6074	57	43	43	37
6075	72	41	53	40
6076	61	35	34	34
6077	71	29	26	26

Properties of Silicone Rubber Filled with Valron at Elevated Temperatures

The only filler known at present which provides reinforcement in silicone rubber which is comparable to the reinforcement found in hydrocarbon rubbers is Valron, an organo-coated silica produced by the Grasselli Chemical Division of E. I. du Pont de Nemours & Co., Inc. With the use of this filler, tensile strengths have been obtained which range from 1500 to 2000 psi.; elongations, from 600 to 900%; and tear strengths, in the vicinity of 200 pounds per inch. If silicone rubber, filled with Valron, showed no greater % decrease

[6] ASTM Method D 624-54, die B used.

TABLE 3. PROPERTIES OF SILICONE RUBBERS CONTAINING GLASS WOOL AT ELEVATED TEMPERATURES

Compound No.	Parts	Filler	Test	Temperature, °F. Room Temperature	200	300	400
6038	50	Hi-Sil X-303	Tensile	692	432	367	271
			Elongation	285	210	205	160
			Tear	71	56	34	35
6074	50	Hi-Sil X-303	Tensile	719	495	187	193
	5	Glass Wool	Elongation	260	195	100	75
			Tear	57	43	43	37
6075	50	Hi-Sil X-303	Tensile	749	457	360	208
	10	Glass Wool	Elongation	220	195	160	65
			Tear	72	41	53	40

Press cure: 15 minutes at 250° F.
Postcure: one hour at 300° F., 24 hours at 480° F.

NOTE: All compounds contained 1.5 parts benzoyl peroxide.

in properties at elevated temperatures than other silicone rubber compounds, Valron-reinforced silicone rubbers would exhibit superior tensile strength, elongation, and tear strength at elevated temperatures.

Experiments were conducted to determine whether this premise were true. Several compounds containing Valron were mixed and vulcanized. Three of the compounds varied only in their Valron content; the formulations were as follows:

Formulation	6087	6088	6089
General Electric 81465 (a methylsiloxane having a high molecular weight)	100.0	100.0	100.0
Valron	45.0	50.0	55.0
Benzoyl peroxide	0.5	0.0	0.5

Press cure: 15 minutes at 250° F.
Postcure: 16 hours at 300° F.

The other compound which was investigated was Cohrlastic HT 655, a proprietary material of The Connecticut Hard Rubber Co. This material is a silicone rubber which contains Valron as well as an antioxidant. The addition of antioxidant extends the serviceability at high temperature from 325 to 450° F. The protection of Valron stocks by means of antioxidants has been previously described.[7]

Figure 8 and Table 5 show the properties of these four compounds at room temperature and at elevated temperatures. With respect to Compound Nos. 6087, 6088 and 6089, the % decrease at 400° F. in tensile strength was approximately 75; in elongation, approximately 55; and in tear strength, approximately 55. The decrease in tensile strength was slightly greater than that normally observed with other silicone rubber compounds; the decrease in elongation was approximately the same; and the decrease in tear strength was somewhat less.

At 400° F. the actual values for tensile strength ranged from 384 to 446 psi.; these values are approximately 1½ times larger than the best value obtained with a silicone rubber containing another filler. Elongations ranged from 305 to 340%, approximately twice the best value of other conventional silicone rubber compounds. Tear strengths ranged from 104 to 114 pounds per inch, approximately 2½ times the best value of other conventional silicone rubber compounds.

Cohrlastic HT 655 proved to be even better. At 400° F. the tensile strength was 665 psi., which is twice the best value of other conventional compounds. The elongation was 610%, which is again four times the value of other conventional compounds. The tear strength was 103 pounds per inch, which does not differ appreciably from the compounds containing Valron alone, but which is still 2½ times the best value of other conventional silicone rubber compounds.

[7] F. L. Kilbourne, Jr., C. M. Doede, K. J. Stasiunas, RUBBER WORLD, 132, 193 (1955).

TABLE 5. TEAR STRENGTH OF SILICONE RUBBER FILLED WITH VALRON AT ELEVATED TEMPERATURES

		Tear Strength, Lbs./In.				
		Scott Tester	Test Apparatus			
				° F.		
Compound No.	Parts Valron	Room Temperature	Room Temperature	200	300	400
6087	45	183	197	223	123	104
6088	50	212	237	171	161	107
6089	55	239	257	153	149	114
Cohrlastic HT 655*		207	197	173	150	103

NOTE: Compound Nos. 6087, 6088, 6089 contain 0.5-part benzoyl peroxide.
* Contains antioxidant.

Discussion of Results

The results of this work clearly point out that silicone rubber, admittedly resistant to high-temperature aging, would not be completely adequate for many high-temperature uses. A selection of the proper rubber compound for applications at elevated temperatures is usually based on resistance to aging. Compression set, measured at or near the service temperature, is sometimes also required. Compression set is a test of per-

(Continued on page 876)

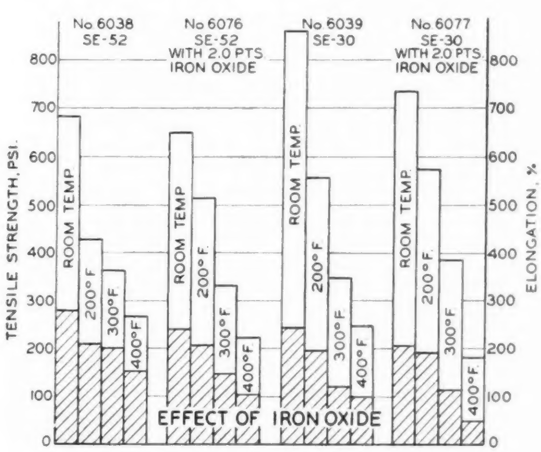


Fig. 7. Effect of iron oxide concentration on silicone rubber compounds at elevated temperatures

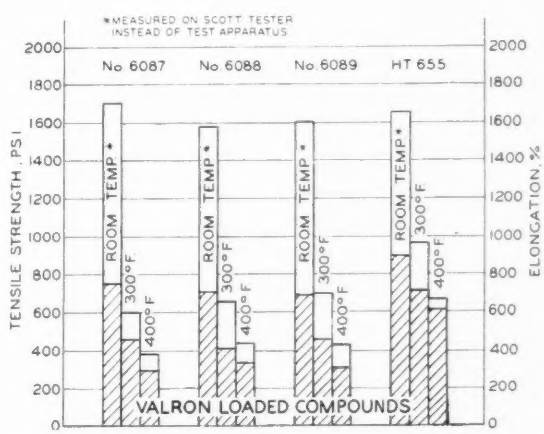


Fig. 8. Properties at elevated temperatures of silicone rubber compounds reinforced with Valron, an organo-coated silica pigment

Aluminum Block Heater for Aging Rubber and Rubber Compounds At High Temperatures

By E. J. BRADBURY and R. A. CLARK
Battelle Memorial Institute, Columbus, O.

Construction details for the building of a rectangular aluminum block heater for the aging of rubber and rubber compounds according to the test-tube method are described in this article. Included are a complete parts list, wiring diagram, machining specifications for the aluminum block, and a description and explanation of the control panel components.

RUBBER compounds are consistently being artificially aged at higher and higher temperatures. Much of the demand for aging at high temperatures is brought about by efforts to produce rubber compounds for the Air Force that will withstand temperatures of 400° to 550° F., sometimes in contact with synthetic lubricants and hydraulic fluids. At these temperatures the usual circulating-air oven is difficult to control and often introduces a potential fire hazard, especially when rubber samples are immersed in organic fluids.

The purpose of this article is to describe the construction and operation of an aluminum block heater which has been found satisfactory for the aging of rubber compounds at these higher-than-usual aging temperatures. The same equipment, with adjustment in heater capacity, has operated quite satisfactorily at temperatures from just above ambient to 800° F.

The use of a circular aluminum block, fitted with electrical heaters and drilled to hold test tubes for aging rubber, has been described by the B. F. Goodrich Chemical Co.[1] The first aluminum block heaters constructed by the authors adapted the Goodrich design to a rectangular aluminum block so that a larger number of samples could be aged. Smaller circular aluminum block heater has since been commercialized.[2]

So far as is known, each of these heater designs has given very satisfactory service. A large part of their excellent performance has probably been due to the stabilizing effect of the aluminum mass and heat capacity on temperature control. This article, however, will describe only the rectangular aluminum block design.

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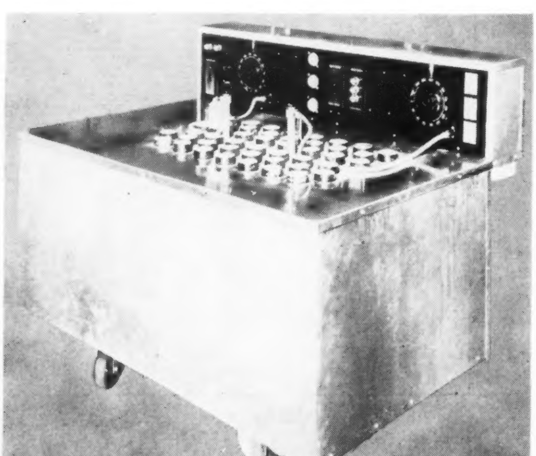
[1] "Hycar Technical Newsletter," No. 10, p. 5, Sept. 1, 1952.
[2] Scott Testers, Inc., Providence, R. I., Model LG aluminum aging block heating bath.
Product Packaging Engineering, Culver City, Calif. Comet Model 600 laboratory aging block. Also distributed by C. P. Hall Co., Akron, O.



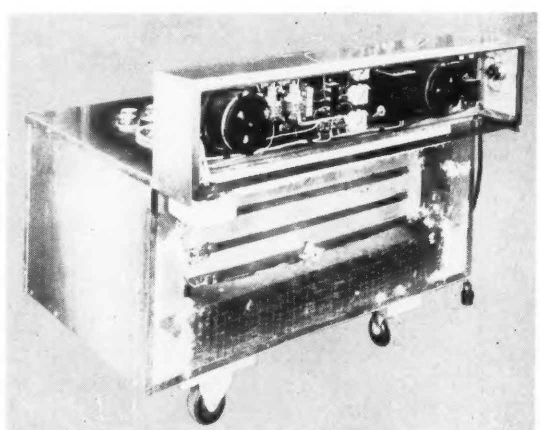


Fig. 1. Front view (left) and rear view (above) of aluminum block heater for aging of rubber and rubber compounds

Design and Construction Details

The details for the fabrication of a rectangular aluminum block heater are presented in Figures 1 to 5; while the actual materials required are tabulated in Table 1. A section of an aluminum ingot was obtained, which when machined was approximately 18 by 36 by 10 inches. Since the ingot as received has somewhat curved sides and shrink holes, the original size, about 19 by 36 by 10 inches, was machined to obtain level sides for the mounting of strip heaters. While other shapes of aluminum can be utilized, these are often formed only by special casting or forging operations, which greatly increase the cost of the aluminum.

This size of ingot section can be drilled with holes to contain as many as 60 test tubes having a diameter of 38 millimeters (about 1.5 inches). This number of holes does not impair the uniform conduction of heat to all parts of the block from the electrical strip heaters placed on the sides of the block. Test tubes placed at various locations in the block all read the same temperature, provided empty holes were corked to prevent local cooling.

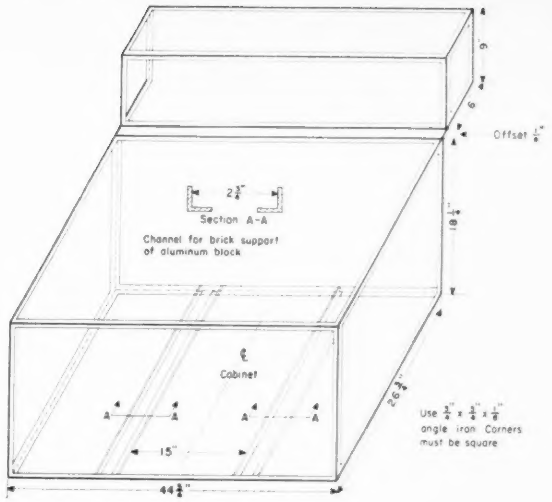


Fig. 3. Diagram of cabinet frame for heating block

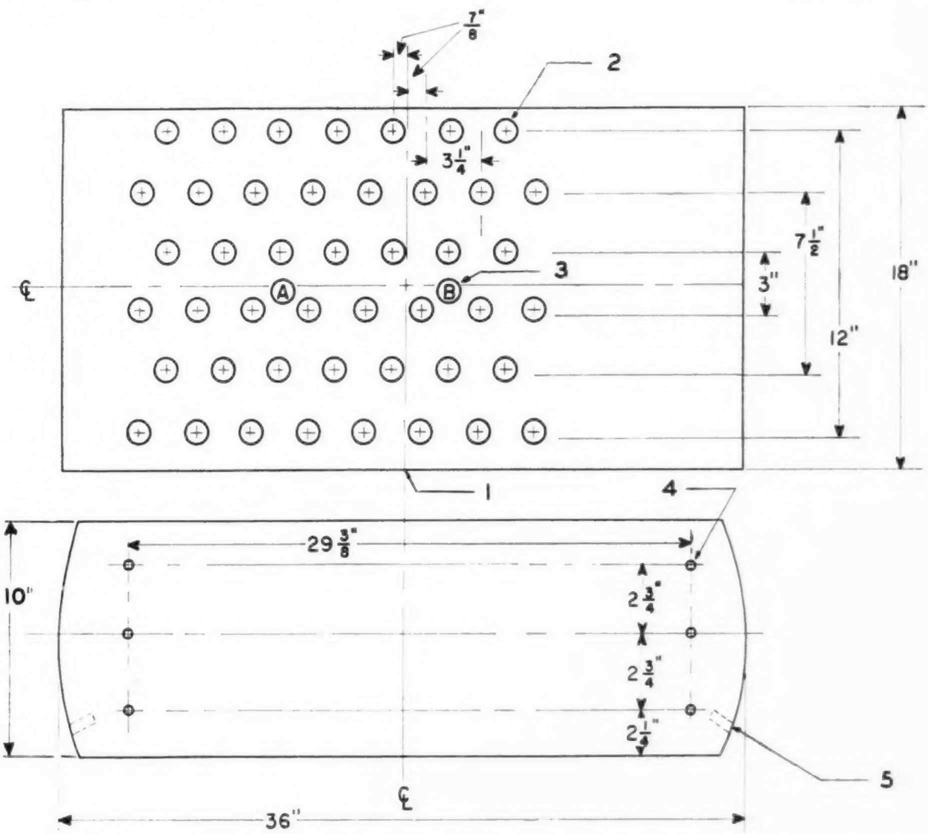


Fig. 2. Machining specifications for aluminum block: (1) Lay out block from center line as shown. (2) Drill 60 holes, 1-13/16 inches in diameter and 7 inches deep overall with spacing as shown (45 holes only in above diagram because space at left reserved for holes of different dimension). (3) A, B, thermoregulator holes, ¾-inch in diameter by 7 inches deep. Locate in the center of the two three-hole patterns as shown. (4) No. 7 drill, 1¼ inches deep, tap, ¼—20NC—1, 6 holes, two sides, for mounting strip heaters. (5) Drill lifting pinholes, two per end; size depends on lifting device that is used

TABLE 1. PARTS LIST AND SPECIFICATIONS FOR ALUMINUM-BLOCK HEATER

Item	Part	Specification	Source*
1	Aluminum block	As-cast ingot, 10 by 36 by 19 inches Alloy 2S Machining details given in Figure 3	Aluminum Co. of America
2	Aluminum tubing	1¾- by 0.058-inch—Type 61S	———
3	Cabinet frame	¾- by ¾- by ⅛-inch angle iron Frame details given in Figure 4	———
4	Cabinet	Sheet aluminum	———
5	Insulation	B. H. Monoblock, 36 by 6 by 4 inches	Baldwin-Hill, Trenton, N. J.
6	Strip heaters	4 — Type SN-3045 strip heaters, 230 volts, 450 watts, Monel sheath 2 — Type SNH-30 strip heaters, 230 volts, 1000 watts, Monel sheath	E. L. Wiegand Co., Pittsburgh, Pa.
7	Temperature controllers	2 — No. 13150 Fenwal controllers Modifications: (1) Length of temperature sensitive shell, 11 inches to flange (2) Lead wire, 28 inches (3) Armored cable, 28 inches	Fenwal, Inc., Ashland, Mass.
8	Variacs	2 — Type V10H	General Radio Co., Cambridge, Mass.
9	Transformer	100 volt - amperes, Catalog No. 710-21, 230 volts to 115 volts G-E	———
10	Relays	2 — Mercury relays, Catalog No. 7020, 110-volt coil, 30 amperes	H. B. Instrument Co., Philadelphia, Pa.
11	Resistors	4 — 1 watt, 4700 ohms 2 — 40 ohms	H. B. Instrument Co., Philadelphia, Pa.
12	Condensers	2 — 0.005 microfarad	———
13	Control jacks	2 — Cinch-Jones plugs No. P 302CCT 2 — Cinch-Jones sockets No. S-302-FP	———
14	Selector switches	3 — Cutler-Hammer Model C-2 DPDT 30 amperes, 125 volts, alternating current	———

*Where items and sources are not specified, any general supplier of the desired equipment should be able to furnish the necessary part. Materials used in the construction of this unit are not necessarily recommended over other comparable materials that can perform the same function.

CAUTION: The Fenwal controllers specified for these blocks are tension operated and should not be inserted in a hot block without first setting the Fenwal to the approximate block temperature. Conversely, a Fenwal in a heated block should not be reset for a temperature lower than 200° F. below the block temperature. In either case, the stress induced may damage the controller.

TABLE 2. FUNCTION OF CONTROL-PANEL COMPONENTS — FIGURE 4

Component	Function
Master switch	This is a double-pole single throw switch that disconnects both legs of the 230-volt supply.
Main indicator light	This light glows when power is on. Power failure or a burned-out instrument fuse or main fuse will prevent lighting.
Temperature-indicator	This indicates block temperature relative to control-temperature setting of the Fenwal regulator. Light burns when the block temperature is low and controller is calling for heat. Circuit will not supply heat, however, unless heater switch, center of panel, is on and selector switch is set for heat.
Instrument fuse	This is a low-amperage instrument fuse used as protection in the transformer circuit. Failure turns out all indicating lights.
Master plug-type fuse	This is a 20-ampere fuse used to protect against overload or major short in the unit. Failure cuts all indicating lights.
Left Variac	This is wired to govern the input voltage to the top pair of heaters. This set of heaters is controlled manually and is continuous when it is in operation.
Heater fuses	Fuse protection is provided for each set of heaters, i.e., top, center, and bottom. The plug fuses are oriented in the same relative position as the heater sets protected. Failure of a fuse will turn off the corresponding indicator light.
Heater-circuit switches	On-off switches are provided for each set of heaters and are positioned like the set controlled, i.e., top, center, bottom.
Heater-circuit indicators	An indicator light is provided for each heater circuit. Failure of the light when the switch is on and the fuse intact indicates the power has been cut off by the safety Fenwal controller. If all lights are out, points listed under (B) should be checked.
Right Variac	This governs the input voltage to the center (Fenwal controlled) pair of heaters.
Heat-selector switches	A selector switch is provided for each pair of heaters, i.e., top, center, and bottom. Orientation of the switch is the same as that of the heater set controlled. Each selector switch has three positions: (1) toggle up—high heat (2) toggle center—no heat (3) toggle down—low heat Note: It is advisable to switch off either the main power or the heater-circuit power before changing the selector switch. Heater circuit indicator lights are not controlled by the selector switches. Lights may be burning, therefore, without heat going to the block if the selector switches are in the "off" position.

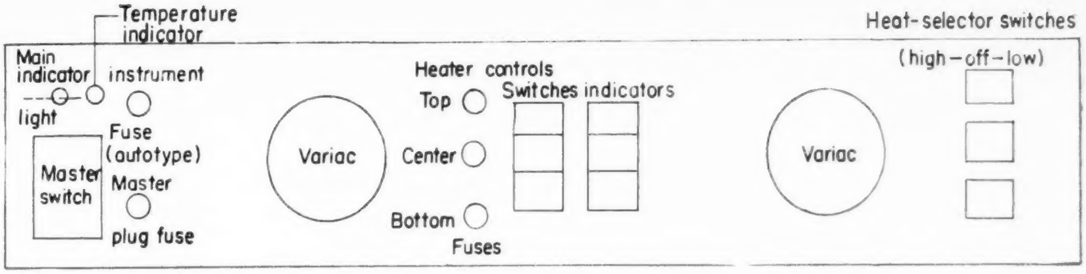


Fig. 4. Details of control panel for aluminum block heater

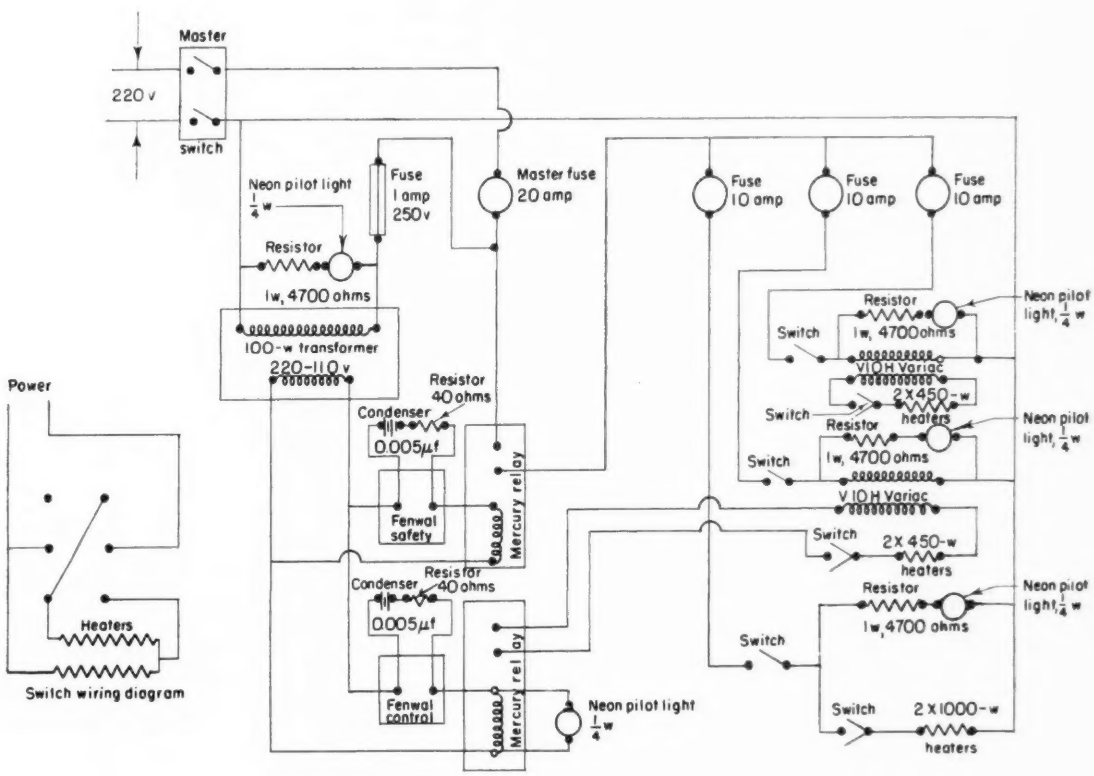


Fig. 5. Wiring diagram for aluminum block heaters

The machined and drilled aluminum block, fitted with strip heaters, was placed on a low heavy-duty dolly in an insulated cabinet. Firebricks were used as supports for the aluminum block, as both strength and insulation were desired by this support. The cabinet was fitted with high-temperature insulation and equipped with electrical controls that maintained a regulated uniform temperature.

While the relatively inexpensive controls selected were totally adequate and found to be reliable for continuous service for more than two years, many other controls could be adapted to this general design. The advantages that might be offered by a more elaborate and expensive control system, however, are of doubtful value, except when extremely small temperature variations are demanded.

Controls

The control system employed was designed with a view to provide (1) a continuous supply of heat to the block that was just short of the desired temperature, (2) an intermittent supply of heat that would be slightly in excess of that needed to attain the desired temperature, (3) a temperature regulator that would shut off the intermittent heater when the desired temperature was attained, and (4) a second temperature regulator to control all heat input in the event of an excessive overheat.

The two Variacs were installed in the system as a means of adjusting the heat input of the continuous and intermittent heaters, which comprise the top two pairs of heaters. The lower pair of heaters, controlled

only by selector switches, were available for supplying additional heat. The setting of the Variacs, to a large extent, determined the temperature variance obtained. With a little experience, temperatures were maintained with $\pm 2^\circ$ F. for operating temperatures of 350-550° F. At 800° F. the variation was about $\pm 5^\circ$ F.

The arrangement of the electrical components is shown in Figures 4 and 5. Instructions for operating the control panel are presented in Table 2. In the actual wiring of this system, it is highly desirable to make connections to the heaters with wire that is heat resistant, as ordinary copper wire will crystallize, and its insulation will burn off.

Summary

A description is given of the design and construction of an aluminum block heater, drilled with holes to contain test tubes for the aging of rubber or other organic materials at temperatures up to 800° F.

Acknowledgment

The equipment described in this paper was designed and constructed for the hot-oil aging of rubber specimens on a research project sponsored by the Wright Air Development Center. The writers are indebted to this sponsor for permission to publish this paper. The opinions expressed in this paper, however, are those of the authors and do not necessarily represent those of the Wright Air Development Center.

Compounding Silicone Rubber

(Continued from page 871)

formance, but performance tests should be extended to include measurements of tensile strength, elongation, and tear strength at the service temperature.

It is recommended that in the future, tests conducted for high-temperature applications include resistance to aging, compression set, and other physical properties, all measurements being made at the service temperature.

Summary and Conclusions

An apparatus for measuring tensile strength, elongation, and tear strength of rubber compounds at elevated temperatures was designed and constructed. The test apparatus was integrated with a Scott tensile tester. Emphasis was placed on simplicity of construction and on validity of comparative test results.

The tensile strength, elongation, and tear strength of typical silicone rubber compounds were determined at room temperature, 200, 300, and 400° F. It was found that these properties decrease markedly at elevated temperatures. At 400° F. several silicone rubber compounds, containing Valron as the reinforcing filler, displayed physical properties superior to those obtained with silicone rubbers containing other fillers. Cohrlastic HT 655, a Valron-reinforced silicone rubber containing antioxidant, exhibited the best properties of all of the silicone rubber compounds tested at elevated temperatures.

Acknowledgment

The authors thank The Connecticut Hard Rubber Co. for permission to publish this article. They also acknowledge the support of an earlier project on the same subject by Wright Air Development Center, Contract No. AF 33(616)-2542, and the personal interest of E. R. Bartholomew and other personnel of the Materials Laboratory of Wright Air Development Center in this problem.

Akron Lab Library to Rubber Division

Almost the entire library of the Government Synthetic Rubber Evaluation Laboratory at Akron, O., has been given to the Library of the Division of Rubber Chemistry of the American Chemical Society, which is maintained at the University of Akron.

The gift was made by the National Science Foundation, the agency responsible for the recommendations concerning disposition of the Akron Laboratory and its equipment, and represents a substantial acquisition for the Rubber Division Library. Actual disposal of the Government Laboratory and Pilot Plant was recently made the responsibility of the General Services Administration by virtue of legislation passed by the recently adjourned 84th Congress.

The most valued portion of the gift is about 4,000 CR Reports, the basic copolymer research reports written under the auspices of the former Rubber Reserve Corp. and its successor agencies.

Other important items are a complete set of *Chemical Abstracts* in 50 volumes plus 26 volumes of author, title, subject, and patent indices; a complete set of Beilstein's *Handbuch der Organishen Chemie* in 74 volumes; and a complete set of the Rubber Formulary.

Also acquired were a file of summary cards prepared by personnel at the Government Laboratory covering progress reports relating to the wartime and postwar synthetic rubber program; microfilms of all Rubber Reserve CD Reports; Alien Property Custodian's PB Reports; and many reels of patents relating to synthetic rubber. All of the cabinets and card files needed to hold the reports and summary cards were included in the gift, obviating the necessity of a considerable expenditure for this purpose by the Rubber Division.

According to the Division of Rubber Chemistry, the gift climaxed five months of effort by Norman Auburn, University of Akron president; B. S. Garvey, vice chairman of the Rubber Division; and Ralph F. Wolf, chairman of the Division's library policy committee.

EDITORIAL

Educational Needs of Rubber Technologists To Be Met?

A GROWING pressure for improving the educational and literature facilities for chemists, engineers, and technologists in the rubber and associated industries has been evident during the last several years. A few of the local rubber groups sponsored by the Division of Rubber Chemistry of the American Chemical Society have provided courses in rubber technology for more than a decade. The number and the scope of such courses, moreover, have been growing at an accelerated rate during the past two or three years.

Also, the meeting programs of these local rubber groups have become broader and more informative with the recent trend toward panel discussion types of programs on subjects of specific current interest.

Similarly, the programs of the national technical societies, such as the above-mentioned ACS, the American Society for Testing Materials, and the American Society of Mechanical Engineers, all of which have rubber divisions or committees, have improved and broadened, *but the demand for further improvement in programs, courses, and literature still continues.*

On several occasions beginning with April, 1954, we have used this column to point out the need of a coordinated effort at a national level to provide some means of making the best information on rubber chemistry and technology available to a greater number of people in the rubber industry. In March, 1955, we noted that the Rubber Division, ACS, had formed an Educational Committee to consider these matters. In May, 1955, we tried to explain the interrelation between science and technology in the rubber industry and suggested joint meetings of the divisions of the various national technical societies interested in rubber and high polymers in order that better liaison would result.

In the field of manufacturing technology, as recently as June of this year, the Molded, Extruded, Lathe Cut and Chemically Blown Sponge Rubber Subdivision of the Mechanical Division of the Rubber Manufacturers Association initiated a "Cooperative Educational Program" in order to try to provide a universal language with regard to dimensional tolerances, finishing, quality, etc., of such products. The purpose of this program is to provide a more common ground for discussions between manufacturers and users of rubber products in connection with order specifications so that thousands of dollars of extra, unnecessary costs may be eliminated.

Earlier this year the Rubber Division, ACS, appointed a New Publications Committee which has the responsibility for assembling the material from the several technology courses given by the sponsored local rubber groups. This material will be reviewed by an editorial board, and a text on "Basic Rubber Technology" prepared for publication by the Rubber Division. Also, a program for the preparation of reviews of more advanced nature on specific subjects of particular current interest has been decided upon.

It appears that real progress in improving the educational and literature facilities for the technical man in the rubber industry will be made in the not-too-distant-future. *We urge rubber industry management to provide maximum support for these very worthwhile and much needed programs in terms of manpower, time, and funds. Their success will mean much in improved utilization of the available technical manpower in the industry.*

R. G. Seaman
EDITOR

Meetings and Reports

German Rubber Society June Meeting; International Aspects Emphasized

Since 1951, when it renewed its activities after an interval of about eight years, Deutsche Kautschuk Gesellschaft (DKG) has steadily grown in importance; its membership has doubled in the meantime, and the number of those attending its international lecture conferences has increased in like proportion. At the latest convention, held in Hamburg, June 6-9, 30 years after its foundation in Düsseldorf on September 25, 1926, almost 600 experts were present, representing, besides Western and Eastern Germany, 18 different countries in Europe and overseas, and 31 well-known scientific organizations and institutes.

The DKG took this opportunity to honor four members for their work in behalf of rubber. The Carl Dietrich Harries Plaque was awarded to Wilhelm Becker of Farbenfabriek Bayer, A.G., Leverkusen, in recognition of his outstanding work on the development of the polymerization chemistry of synthetic rubber; and to Jean Le Bras, of the Institut Français du Caoutchouc et Institut des Recherches sur le Caoutchouc en Indochine, Paris, France, for his valuable services in the field of natural rubber science and technology. Harry Heering, Berlin, and Heinrich Pahl, Düsseldorf, received the Merit Plaque of the DKG for their effective promotion of the organization's aims.

The accompanying photograph taken at the banquet of the DKG on June 8 shows, left to right, Dr. Fromandi, Leverkusen, vice chairman; Dipl. Ing. Titze, Frankfurt a.M., managing committee; and Dr. Giese, chairman.

An innovation this year was the exposition of testing machines, held in connection with the conference, when many manufacturers showed their latest designs for physical and chemical testing apparatus.

At the conference, which was opened by the DKG chairman, Otto Giese, 37 papers were offered, summaries of which follow. Except for the American speakers, affiliations could not be determined.

Measurement of Electrical Conductivity of Rubber; Standard Specifications and Fundamental Experience in Measurement Technique. D. Zernial, Hannover.

The differences in foreign and domestic standards and how they affect values obtained, especially as to voltage, performance, time and form of electrode, are discussed with the aid of the author's own measurements; and technical and service requirements are compared.

New Methods in Chemical Analysis of Fillers in Vulcanizates. F. Glander, Hannover.

To determine carbon black in a vulcanizate, use was made of a method based on distilling off the volatile components in a hydrogen stream and calcining the residue. It was shown that the various blacks can be arranged in a sequence according to calcination losses and the type of black deduced from the differences in values obtained under different test conditions. Tests were, at the same time, made to determine zinc oxide in vulcanizates from ash at 950° C. The process, carried out in a hydrogen stream, involved reducing zinc oxide to metallic zinc and distilling off the Zn at about 950° C. The two tests can be combined; from the difference in the ash at 950° C. and the residue after carbon black determination, the ZnO content is obtained.

Plasticity Tests: Reproducibility and Correlation Plasticity of Various Tests. G. E. Williams, Manchester, England.

The reproducibility and correlation of plasticity tests were studied with the Williams parallel plate plastometer, the Mooney viscometer with rotating disks, and the Defo plastometer. It was found that the relation between the Mooney and Defo results and the Williams and Defo results are linear. When a linear relation (as an approximation) was assumed between the Mooney or Williams results and the logarithm of the Defo results, the relative deviations of the three methods could be estimated.

New Considerations on the Stress-Strain Behavior of Rubber. F. H. Muller, Marburg.

There are many gaps in the thermodynamic-statistical theory of rubber elasticity, especially in the case of high deformation. Experience gained from recent deformation tests on high polymers, especially cold stretch tests, was applied to the investigation on deformation phenomena in rubber. The lecturer showed what new insights are yielded by this new knowledge on deformation and the measurements in the transition zone. Thus it was found that it is not possible to realize either an ideal iso-adiabatic or an ideal isothermic deformation. Thermal measurements, however, permit better analysis than before of the energy balance of stretching in its reversible and irreversible parts.

Oxidative Degradation of Natural and Synthetic Rubber in Latex. Herte, Schkopau.

This lecture considered chiefly the work at Schkopau on Buna S3, and the recently developed Buna S4 which requires no thermal degradation before processing. Buna S3 is tougher than Buna S4 and, even when degraded to the plasticity of the latter, still tends to recover its original plasticity.

Chemical degradation of Buna S3 and natural rubber in latex is described; the process for Buna S3 employs metal soligens and alkylphenols as degradation catalysts. It is noted that under this treatment too, Buna S3 retains the tendency to recover its original plasticity, and work on the effect of so-called anti-recovery agents was undertaken.

It was also attempted to produce Buna S4 and Buna S3 together in the same polymerization battery, continuously degrading part of the stream of Buna S3 to the plasticity of Buna S4. This method

Foto-Brandts

Left to right: Dr. Fromandi, Dipl. Ing. Titze, and Dr. Giese at DKG banquet

proved less satisfactory than the production of Buna S3 and S4 in succession, in a so-called re-regulation process.

Thermal oxidative degradation of natural rubber in latex, with the catalysts for Buna S3 and with secondary amines, proved considerably faster than for the synthetic latex. The properties of this rubber and the rate of degradation in relation to reaction temperature and concentration of catalysts were mentioned.

Paper Chromatography in the Analysis of Rubber Compounds. Part I. Accelerators. Part II. Antioxidants. Rudolph Miksch, Munich.

For application to accelerators, the chromatography process employs the acetone extract of the compound as starting material: the different preliminary treatment required for acidic and basic components is described. Identification was satisfactory in the case of 17 out of 20 accelerators tested and took 2-2½ hours, starting with the acetone extract. Identification of antioxidants proceeds directly from the vulcanizate and requires two hours. Paper chromatography was shown to be a simple method by which accelerators and antioxidants can be clearly and easily identified.

Tires and Riding Properties. F. Gauss, Stuttgart.

The elastic tire influences the behavior of the rapidly traveling motor vehicle. The processes involved come under the heads: driving and braking; lateral forces and cornering; and resilience (springing). The role of the tire in each case is discussed in detail.

Dielectric Heating in the Rubber Industry. H. Bauermeister, Hannover.

After reviewing the developments in dielectric heating in the last 20 years, the author briefly explains the physical principles. The advantages of the method, as compared with heating by thermal conduction, are discussed, and also the difficulties encountered. Finally, it is demonstrated by existing installations what the possibilities are for industrial application of dielectric heating today.

Stress Relaxation in Cross-Linked Elastomers. J. A. Clayton, D. C. Marshall and D. L. Walker, Birmingham, England.

The theoretical significance of stress-relaxation of cross-linked elastomers is discussed in connection with three experiments: (1) The rates of stress relaxation and of elongation at constant load were determined for samples of carbon black compounds which had first been slightly prestretched, and the mathematical relations worked out. (2) The changes in electrical conductivity found for stretched black-filled rubber were measured on the basis of stress-relaxation, leading to conclusions on the way in which the carbon particles are displaced by stress relaxation. (3) Stress relaxation in black-filled neoprene samples, subjected to ultrasonic vibration, was examined. The rate of stress relaxation showed no increase except for that resulting from the rise in temperature caused by the ultrasonic vibrations.

Some Thermal and Mechanical Properties of Electrically Conductive Rubber. S. de Meij, Delft, Netherlands.

In order to learn some of the laws governing the properties of electrically conducting rubbers, tests were conducted on two natural rubber compounds containing 50 parts HAF and 50 parts SAF carbon black, respectively. The relation of conductivity to temperature was determined by the temperaure coefficient of the black, the formation of carbon black chains at higher temperatures, and the rupture of the chains as a result of thermal movement of the rubber molecules.

The critical temperature for the mixes tested was 70° C. At higher temperatures chain scission predominates, and resistance increases considerably. A single deformation increases resistance by leaps and by bounds. Recovery always takes place, with the value for conductivity (I) corresponding to $I = A \log t + B$ (t equals time). The way in which the constants A and B depend on the type of black, on the load, and on variations in load as well as temperature, was explained.

The Swelling Rate in High Molecular, Cross-Linked Polymers. P. Szor, Budapest, Hungary.

The author reports on partial differential equations for the swelling process in the case of square, cylindrical and spherical test pieces, where both the form of the sample and the swelling coefficient change in the course of the process. The approximation functions of the infinite series obtained are set up, and the equations compared with the results of the tests.

The Nitrogen Content of Solvent Fractions of Rubber. E. Koldehofe, Hannover.

Continuous extractions were carried out, and the nitrogen content of individual fractions was determined; it was found that both soluble and insoluble nitrogen compounds are present in natural rubber, whose ratio in ether, for instance, is about 60:40.

Stress Optics Research on Rubber and Highly Elastic Materials, with the Aid of Test Pieces of Different Shapes. R. Ecker, Leverkusen.

To determine the most suitable form for the smallest possible bar for tensile tests and the best shape of a sample for testing resistance to tear growth, experiments were conducted with the aid of stress optical color photographs, on Vulcollan, a natural rubber loaded with silicic acid, unfilled mixes of Polysar, Krylene NS, and natural rubber. Results confirmed earlier findings that the so-called KTA II Bar (Switzerland) is more suitable for small tensile bars, and the angle test according to Graves, for determining resistance to tear growth.

Judging High Polymer Cable Insulations from Loss Factor Reliefs. K. H. Hahne, Osnabruck.

The loss factor as a function of temperature and frequency of the voltage applied, measured by means of commercial apparatus, yields a typical spatial curve structure which is suitably represented as a three-dimensional relief. It is shown that series of measurements of such reliefs permit deductions to be made on the action of plasticizers, stabilizers, and fillers in polyvinyl chloride mixes; the behavior of different types of PVC; rubber mixes; and polythene insulations.

The analogy of results with those of the measurements of tensile, cold resistance, and insulation resistance, is demonstrated and substantiated, and the advantages are emphasized of this method by which even the processing of high polymer cable insulations can be correctly regulated.

The Strength of Pneumatic Tires. W. Hofferberth, Hanau.

The considerable deformation which may take place in a tire, when the internal excess pressure increases, is connected with flex effects. To find the deformation and stress values caused by the additional flex effects, it is necessary to know the meridian curve of the tire under excess internal pressure, and the author explains the necessary calculations. The stresses due to flex and membrane stress conditions can be broken up into the partial stresses to be absorbed by the individual components of the tire wall. By comparison with the permissible stresses of the materials in these components, the values insuring freedom from failure through rupture or permanent deformation can be obtained.

Measurement of the Sideways Angle in Tires on Motor Vehicles Traveling on a Circular Track. H. Luetgebrune, Hannover.

When an automobile travels along a curve, the wheels respond by tilting at an angle, resulting in so-called lateral driving forces. The usual methods of determining these forces and the application of results to road tests are discussed. Attention is called to a new device which permits the measurement of the sideways angle of the wheels on a vehicle traveling in a circular track as well as the tilt of the car and the absolute track speed. The effect of the air pressure of the tire on the sideways angle and the effect of the vehicle on cornering properties are also shown.

Tire Abrasion under Various Climatic Conditions. R. Houwink, Delft.

Relative abrasion resistance values as well as absolute values (weight loss in grams per 1,000 kilometers) were determined for various grades of treads in road tests. Each of the tread types tested was found to depend in its own way on the ambient temperature, so that it cannot simply be stated that one tread type has more abrasion resistance than another. Thus at over 15° C. an oil-extended natural rubber tread, made with ISAF black, showed considerable advantages over the natural-rubber HAF black compound serving as standard in the tests.

Recent Advances in Rubber—Physics. A. Schallamach, Welwyn Garden City, England.

The subjects treated were the elastic behavior of loaded mixes, the tear strength of rubber, and the abrasion of rubber.

Quantitative Determination of Antioxidants. J. W. H. Zijp, Delft.

The methods developed at the Rubber Research Institute T.N.O., Delft, for the quantitative analysis of phenylbetanaphthy-

lamine and diphenyl-p-phenylenediamine involve: (1) extraction of the antioxidant from the rubber mix; (2) separation of impurities, etc., by means of chromatography on fully acetylated paper; (3) extraction of the paper, and (4) colorimetric determination. The process takes two hours.

The Effect of Antioxidants and Antiozonants on the Ozone Resistance of Natural Rubber Vulcanizates. B. I. C. F. van Pul, Delft.

The effect of 30 protective agents is described. It was found that some of the antioxidants act also as antiozonants, but others gave no similar results, or gave a negative result. The effect of increasing the concentration of antioxidants on the ozone resistance of vulcanizates was also studied. Finally it was attempted to describe the connection between the chemical structure of the antiozonants and the properties found.

Tear Tests on High Filled Polymers. E. Hampe, Hannover.

The preparation of samples of vulcanized rubber for testing behavior during tear growth and the conditions of the tests are described. The diagrams of the rupture surfaces are discussed within the frame of the rupture theory. Details of the tests are to be published when these have been completed.

Static Investigations on V-Belts. K. H. Bohndick and K. Voelz, Hannover.

The investigations were aimed at providing indications as to the extent that existing pulley diameters may be decreased, or strains increased for newer types of V-belts, while maintaining the service life of the older types. Continuous running tests were carried out to set up Woehler curves, in connection with which the following factors were varied: pulley diameter, bending frequency (by selecting two different belt lengths), axle load, belt width (two different profiles).

New Synthetic Rubber Plant of the Bunawerke Huls, G.m.b.H., in Marl, Kreis Recklinghausen. P. Baumann, Huls.

The new plant will include a section for the manufacture of butadiene from n-butane, according to American methods, and installations for the actual production of 45,000 tons annually of Buna Huls K (cold rubber). This is a butadiene-styrene copolymer produced by the redox system of polymerization at about 5° C; it will have a Defo hardness of about 800, or Mooney viscosity of about 46-58, and can be processed like natural rubber, that is, without preliminary thermal dêgradation.

Recent Developments in Perlon and New Knowledge on the Polyester Fiber, Trevira. K. Jehle, Hoechst.

Within certain limits, suitable stretching was found to improve Perlon (caprolactam nylon) for use in tires, better shrink values were obtained by separating hot stretching and fixation. The latter takes place at such high temperatures that shrink resistance close to the softening point is attained. Unlike the melting point, the softening point for Perlon differs by but a few degrees from that of nylon.

Various testing methods, particularly the new dynamic tests, are discussed. It is suggested that part of the difference in experimental and practical results may be due to oxidative influences.

Trevira is the new polyester fiber which Farbwerke Hoechst A. G. is producing under license from Imperial Chemical Industries. Its properties are compared with those of polyamide fibers. The problem of adhesion to rubber has not yet been satisfactorily solved.

Arctic Rubber. F. J. Ritter, Delft.

Rubber fails at low temperature because of crystallization or because it passes into the "glassy state" second-order transition. At Delft the opinion seems to be that it is necessary first to combat crystallization, and non-crystallizing elastomers have been produced in the laboratory there by the synthesis of so-called "quasi polymers" from natural rubber. In these products only a part of the isoprene units of natural rubber is chemically modified; the cold resistance of such products is said to be very good, and if cold-resistant plasticizers are used, materials with unusually good low temperature properties are obtained.

Vulcanization of Rubber. W. Scheele, Hannover.

This paper was a survey of studies on the kinetics of vulcanization of natural rubber by tetraalkyl thiuram disulfide and of tetramethyl thiuram monosulfide and sulfur in presence of excess ZnO. The decrease in the concentration of all thiuram disulfides during the process was investigated as well as the increase in zinc dithiocarbaminates, as functions of curing time and temperature.

Both are first-order reactions, and in both cases values for activation energy could be determined from their temperature function. The limit of the yield in dithiocarbaminate (66 mol%) is independent of the concentration of thiuram disulfide or the amount of ZnO (if the latter is always in excess). Vulcanizations with tetramethyl thiuram monosulfide and sulfur, in the proportion of one mol of the former to one gram atom of sulfur, proceeds in exactly the same way as vulcanization with tetramethyl thiuram disulfide. The kinetics of thiuram vulcanization of natural rubber resemble those of dibenzoyl peroxide vulcanization.

Properties and Performance of Furnace Blacks in Tire Treads. W. Westlinnig, Kalscheuren.

The characteristics of ISAF and SAF blacks, as well as of HAF, in natural rubber treads, the properties they confer, as well as their processing qualities as shown in extrusion curves, are fully explained. With them are compared the MPC black, and it is pointed out why the furnace blacks are so largely used in the United States. Performance results in Nurnburg Ring tests, their accuracy and reproducibility are analyzed. Similar studies are in progress with synthetic rubber treads.

Thermal Conductivity of Natural and Synthetic Rubber Vulcanizates. W. Backes, Aachen.

To express the thermal conductivity of natural and synthetic rubber vulcanizates, use was made of the temperature conductivity number k (usually indicated by a^2 in the literature). In the theoretical part of the lecture the mathematics of determining k and relating it to thermal conductivity was explained. In the experimental part, results were discussed of the measurements carried out on cylindrical samples; unfilled Buna S3 gave the highest k value, and unfilled butyl rubber, the lowest; carbon black compounds gave higher values than those without carbon black; in the case of natural rubber, k increased with increasing volume of black. In oil-plasticized synthetic rubber with a high proportion of softener (Buna OP 50) k decreased markedly.

The method, which takes about 25 minutes, provides a way of classifying rubbers according to their thermal conductivity by determining k; it can be carried out in any laboratory and yields reproducible values in adequate amount.

Cinematic and Dynamic Investigations of the Notch Strength of Vulcanized Rubber Compounds. A. Chiesa, Milan, Italy.

In order to bring laboratory results in better accord with observations in practice, notch strength tests were carried out under a variety of conditions with modern electronic devices which accurately record values for the different tear phenomena. In some cases a stroboscopic apparatus was used, and cinematographic views of samples during the tearing process and at the same time, of course, of oscillograph curves were obtained so that the "strain-tear" curves as well as the "strain-time" curves could be determined.

Cinematic pictures revealed that the tear phenomena at low extension speeds occur so rapidly that the progressive extension of the sample, while it is tearing, may in practice be ignored; the strain applied serves only to initiate tearing. The phenomena during tear growth are independent of extension and so are to be considered a property of the sample tested. Hence each sample can be distinguished by the duration of its own spontaneous tear growth (for a definite shape). The tests were made on some of the main types of test pieces.

Deformation Properties of Rubber Vulcanizates. P. Kainradl and F. Handler, Traiskirchen.

The authors give a comprehensive survey of the behavior of vulcanizates under static and dynamic strains. They critically review the literature so far on the elasticity of rubber and systematically arrange the various methods of measurement, pointing out deficiencies; definitions and concepts used in describing the behavior of rubber are evaluated, and definitions and concepts used by the authors proposed. The influence of the shape of the vulcanizate, of different kinds of strain (traction, pressure, and shear), and of testing conditions is dealt with.

Deformation properties under static load as well as under rapidly alternating strains are discussed in detail, and the distinction made in current literature between static and dynamic E modulus is debated. It is suggested that for the description of all

time-dependent properties—deformation, flow, relaxation, elastic after-effect, permanent set—a relaxation spectrum must be assumed by means of which it is possible to connect them all.

Copolymerization of Butadiene and Vinylpyridine. W. Gumlich, Traiskirchen.

At Huls, alpha methyl beta vinyl pyridine is produced by dehydration from aldehyde collidine, similar to the production of styrene from ethyl benzene, after splitting of the pyridine ring was avoided by the selection of suitable catalysts.

The mixed polymer with butadiene and styrene has been put on the market experimentally under the name of "Bunatex Vp"; it is intended primarily for impregnation of fibers to increase adhesion to rubber. Research on butadiene-styrene-vinyl-pyridine mixed polymers now aims at the production of cold and oil-plasticized rubbers.

Abrasion Studies with a Dunlop Lambourn Machine. W. Viehmann, Fulda.

Further investigations on the abrasion-slip curves, such as were first recorded in the literature by Ebert and Weidner, led to the conclusion that abrasion behavior of a vulcanizate can be indicated by three values: specific energy of abrasion, critical slip, and the steepness of the Schallamach line.[1] The dependence of these three values on temperature, abrasion surface, and prestretching of the sample was studied, and a theory of the abrasion process developed according to which specific energy of abrasion depends on the tearing energy (as measure of the surface energy) and on absolute damping (as measure of the energy of absorption).

Critical slip is directly proportional to the product of the dynamic elasticity constant and tear stress (literally, tearing elongation) and inversely proportional to the abrasion coefficient. The steepness of the Schallamach line is inversely proportional to the dynamic elasticity constant and directly proportional to the abrasion coefficient.

The Direct Reinforcement of Latex. J. Le Bras.

Methods of improving the properties of rubber produced from latex directly reinforced with certain resins were dealt with, and in this connection special attention was given to resorcinol-formaldehyde. Investigations covered: (1) addition of macromolecular combinations like cyclized rubber or high styrene copolymers; (2) action of aldehyde carriers, among which certain polyfunctional substances seem very promising; (3) action of glycol, which also has given notable results.

Vulcanization problems were also studied, including the possibilities of retarded acceleration. The influence of various factors on the shape of the vulcanization curve was shown, especially the exchange of free and organic sulfur, the absence of traces of tri-valent iron, and the retarding action of glycols.

Contribution to the Thermovulcanization of Buna. H. Luttropp, Schkopau.

All of a number of Buna types produced at Schkopau yielded products having the properties of soft rubber when subjected to thermovulcanization in the absence of air and oxygen but the ease with which this result was effected varied for the individual rubbers. Addition of active carbon (CK3) increased the thermovulcanizing effect for synthetic rubber. Values for tensile strength, elongation at break, and tear strength were fairly similar to those of the usual sulfur-accelerator compounds, but were definitely better for abrasion resistance, rebound elasticity, surface cracking, and resistance to aging.

The Chemistry of Reinforcement—III. Model Systems Containing Carbon Black and Squalene. Merton L. Studebaker and L. G. Nabors, Phillips Chemical Co., Akron, O.

Model systems have often been used to study the chemistry of vulcanization. In designing these model systems rubber is replaced by a simpler organic molecule, for instance, dihydromyrcene. The vulcanizing agents are heated with this relatively simple molecule at times and temperatures commonly employed during vulcanization. The products of reaction are studied, and conclusions about the chemistry of vulcanization are arrived at by analogy.

This technique was used to study phenomena which take place at the surface of carbon black, or in its near vicinity, during vulcanization of reinforced stocks. The systems studied include: (1) carbon black and squalene; (2) carbon black and sulfur; (3) carbon black, squalene, and sulfur; (4) carbon black, squalene, sulfur, MBT, and zinc laurate.

Mixtures of these materials were heated at 150° C., and the liquid fractions removed by extraction for 30 days with toluene. After drying, the solid fractions were subjected to precise ultimate analysis. At least six commercial carbon black samples were used in each series. These were selected to provide a wide range in surface area, hydrogen content, and oxygen content.

The data demonstrate that considerable chemical activity is evident at or in the immediate vicinity of the surface.

Neoprene and "Hypalon"—Recent Developments. N. L. Catton, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

This paper is a sequel to the one on dry neoprene compounding presented by Ottenhoff and DePuy at the DKG meeting in 1953, supplemented with a parallel discussion on "Hypalon," chlorosulfonated polyethylene.

Basic polymer chemistry is discussed briefly for both types of synthetic rubber. A discussion of fundamental compounding and processing principles supplements existing literature such as "Die Neoprene," written by Mr. Catton in 1953 and published in German early in 1955. Particular emphasis is put on comparisons of the sulfur-modified neoprenes and the W-types (including the new Type WX) from the viewpoint of the rubber plant compounder. "Hypalon" 20 is treated along with the neoprenes; similarities and differences are pointed out.

A section on special compounding measures discusses the latest findings of the du Pont elastomers laboratory in obtaining specific properties in "Hypalon" 20, Neoprene Types WRT, WX, and WHV, and blends of Type WHV with other neoprenes and butadiene-styrene copolymers. Again the emphasis is on recent developments which have not appeared in German literature. The proper selection of petroleum process oils for use in neoprene is covered in detail, as is the use of selected antioxidants and antiozonants in highly loaded neoprene stocks. Curing systems for "Hypalon" 20 and the W-type neoprenes are still being improved or discovered, and present knowledge on these subjects is presented in detail.

The general properties of vulcanizates based on "Hycar" 20 and the various types of neoprene are compared. A general indication is made of the relative merits of these and other elastomers in terms of specific vulcanizate properties.

The paper concludes with a review of established neoprene uses and more recent applications for both neoprene and "Hypalon" 20 in the automotive and other industrial fields.

Enjay Butyl—A General-Purpose Synthetic Rubber. E. Arundale and J. P. Haworth, Enjay Co., New York, N. Y.

Butyl has long been considered a polymer primarily for use in inner tubes because of its impermeability to gases and its excellent age and tear resistance. Enjay Butyl, however, also possesses a number of other outstanding properties that have made it of interest as a general-purpose polymer. When properly compounded, butyl rubber possesses excellent abrasion resistance and impermeability to gases, has high tear resistance, superior heat and age resisting properties, resists the action of ozone, chemicals, and solvents, is extremely resistant to flexing, and has high electrical resistivity and dielectric strength.

The compound techniques to be used are dictated by a combination of economics, the mechanical properties desired, and the environmental conditions to be met. A critical selection of the ingredients necessary for vulcanization, reinforcement, plasticization, and processibility has permitted the successful use of butyl in many applications, some of which were previously filled by other competitive polymers. This has also resulted in a marked improvement in certain desired properties.

New Goodyear Rubber Lab

A new $80,000 rubber development laboratory has been put into service by the chemical division of The Goodyear Tire & Rubber Co., Akron, O. Previous development facilities are now devoted to work on light-colored rubber compounds, the company says.

Equipment in the new laboratory includes an extruder with a 1½-inch-diameter screw, a dynamic flex testing machine for outdoor exposure tests, a 16-inch mill, two 12-inch mills, a Banbury mixer capable of handling 2,500 cc. batches, an open steam vulcanizer for curing extruded goods, and a two-deck curing press with 24- by 24-inch platens.

[1] *J. Polymer Science*, 9, 385 (1952).

Wire and Cable Symposium

The fifth annual symposium on "Technical Progress in Communication Wires and Cables," jointly sponsored by the Signal Corps Engineering Laboratories and the wire and cable industry, has been scheduled for December 4-6 at the Berkeley-Carteret Hotel, Asbury Park, N. J.

The program will cover developments in the fields of wire and cable constructions, their characteristics and uses; conducting, insulating, and jacketing materials; manufacturing equipment, processes, and techniques; field construction practices; and end-uses in operating systems.

Howard L. Kitts, telecommunication division, Fort Monmouth laboratories, will be symposium chairman, with Howard F. X. Kingsley as co-chairman. Other committee members are C. T. Wyman, Bell Telephone Laboratories; George Hamburger, Copperweld Steel Co.; Bjorn Jore, Anaconda Wire & Cable Co.; Vincent McBride, Plastic Wire & Cable Corp.; E. J. Burrough, E. I. du Pont de Nemours & Co., Inc.; and Ray Blain, Army Signal Communication Engineering Agency.

Applications for attendance and further information may be obtained from the Symposium Committee, Communications Department, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Chicago Group Tees Off

The annual golf outing of the Chicago Rubber Group was held at the Medinah Country Club, Medinah, Ill., July 27, with 240 of the 335 members and guests who were in attendance competing for the golf prizes.

Francis Ruggles, M. W. Kellogg Co., took low net honors, winning the special trophy awarded in memory of Ralph Anschuetz, a member of the Group who died in May. Scoring the lowest gross for members was Charles Skuza, South Haven Rubber Co.; while C. Thompson marked up the lowest gross for guests. Leading the putters on the practice green was Al Klenk, K & M Rubber Co.

First in the high gross and most putts categories were Bert Oveson, Metro Rubber Co., and Fred Bastian, Johns-Manville Co., respectively. Other golf winners included Ralph Schell, Bauer & Black, and William Behney, Harwick Standard Chemical Co., among the top men in the blind bogie contest; and R. Hagemeyer, Wyandotte Chemical Co., who together with Dick Hosang, New Jersey Zinc Co., and Ed Wagner, Witco Chemical Co., was among the leaders in the Peoria Handicap. R. Sherman and J. Maples won the Peoria Handicap for guests.

Winner of a raffled television set was Harold Shetler, Chicago Rawhide Co. Second and third drawings, a set of irons and a set of woods, were won by Bob Kahn, a guest, and Stan Shaw, Witco, respectively.

John Groot, Dryden Rubber Division of Sheller Mfg. Co., was chairman of the committee in charge of arrangements. Frank Smith, Williams-Bowman Rubber Co., was vice chairman.

Mechanical Goods Meeting

A symposium on mechanical rubber goods will be held by the New York Rubber Group at the Henry Hudson Hotel, New York, N. Y., October 5. Latest developments in belting, hose, small molded goods, cellular rubber goods, compounding, and equipment will be covered in six short talks.

The panelists will be W. L. White, Manhattan Rubber Division of Raybestos-Manhattan, Inc.; J. L. Muller, Thermoid Co.; L. Cranston, United States Rubber Co.; George Sprague, B. F. Goodrich Co.; F. L. Amon, Godfrey L. Cabot, Inc.; and E. Herbert Johnson, Farrel-Birmingham Co., Inc.

New York Group Golfs

The annual golf tournament of the New York Rubber Group was held at Innis Arden Golf Club, Old Greenwich, Conn., August 2, with 190 of the 230 members and guests in attendance participating in the activities on the course.

Among the reported low gross winners were J. F. Wernersbach, Enjay Laboratories; W. B. Curtis, Naugatuck Chemical Division; and F. Salamon, member; and C. Withington, R. E. Nipples, and C. Basilone, guests. Scorers in the kickers' handicap included J. Starin, Harry T. Campbell Sons' Corp.; W. Tepper, Martin Rubber Co.; F. Chittenden, Naugatuck; J. Tumpeer, Tumpeer Chemical Co.; and D. Fish, Thiokol Chemical Corp.

Correction

L. R. Ervin, in his talk before the Chicago Rubber Group, April 27 (RW, July, p. 576), said that by 1966 non-tire production will be doing two-thirds of the rubber industry's business. The year mentioned in the published report, 1956, was a typographical error. Also, the General Tire executive did not himself make the prediction, but quoted a president of a large mechanical goods company as making the forecast.

Peters 1957 Rubber Division New York Meeting Chairman

At a special meeting of the executive committee of the New York Rubber Group held at the Henry Hudson Hotel, August 24, and attended by B. S. Garvey, Sharples Chemicals Division, Pennsylvania Salt Mfg. Co., vice chairman of the Division of Rubber Chemistry of the American Chemical Society, Henry J. Peters, Bell Telephone Laboratories, and a member of the Group's executive committee, was selected to be the chairman of the general committee in charge of the Division's meeting scheduled for September 11-13, 1957, at the Hotel Commodore in New York, N. Y.

Mr. Peters will name the members of his committee later from the New York Group, acting as host for this meeting.

SPE Isocyanate Symposium

Isocyanates are the subject of a symposium to be presented by the Upper Midwest Section of the Society of Plastics Engineers at the Curtis Hotel, Minneapolis, Minn., October 23.

Scheduled speakers and the titles of their addresses are as follows: C. L. Wilson, University of Notre Dame, "Introduction and History of Isocyanates"; M. E. Bailey, National Aniline Division, Allied Chemical & Dye Corp., Buffalo, N. Y., "New Surface Coatings Based upon Di-isocyanates"; George A. Hudson, Mobay Chemical Co., St. Louis, Mo., "Urethane Coatings and Adhesives."

Also E. E. Gruber and O. C. Keplingler, The General Tire & Rubber Co., Akron, O., "Non-Scorching Polyurethane Elastomers"; Joseph Winkler, American Collo Corp., Ridgefield, N. J., "Effects of Foaming Catalysts on Hydrolysis Aging of Urethane Foams"; E. E. Gruber and G. T. Gmitter, General Tire, "Effects of Toluene Di-Isocyanate Isomer Ratios in Polyurethane Foams"; and C. Bradford Muzzy, Nopco Chemical Co., Harrison, N. J., "Use and Applications of Isocyanate Foams."

Cort Platt, Remington Rand Univac, New York, N. Y., is general chairman of the symposium, and Wm. Jarvey, Archer-Daniels-Midland Co., Cleveland, O., is program chairman. Reservations and further information may be obtained from Mrs. Luther Bolstad, 3857 Brookview Drive, Minneapolis 26, Minn. Preprints of the talks are available free to registrants.

NRL "Report" Subscription

"Report of NRL Progress," published monthly by the Naval Research Laboratory, is now obtainable on a subscription basis from the Office of Technical Services, United States Department of Commerce, Washington, D. C. The reports were first issued in January, 1956, on a single-issue basis.

The publications cover such fields as applications research, electronics, chemistry, mathematics, mechanics, metallurgy and ceramics, plastics, optics, nuclear and atomic physics, solid-state physics, astronomy, and astrophysics.

Annual subscription rates are $10, domestic; $13, foreign. Single copies are $1.25.

U. S. World Trade Fair

Rubber, plastics, chemical, and petroleum products will be among the goods featured in a basic materials section at the United States World Trade Fair to be held in the Coliseum, New York, N. Y., April 14-27, 1957. Twenty-three countries, as well as West Berlin, will participate in the affair.

Charles Snitow, president of the exposition, hopes the Fair will become an annual event, similar to the Paris and Milan Exhibitions.

NEWS of the MONTH

Washington Report and National News Summary

. . . Possible Suez Canal closing considered likely to result in only temporary natural rubber shortage in this country. Ample shipping available for the longer "round-the-Horn" route. Higher prices because of higher costs probable, however.

. . . Rubber Producing Facilities Disposal Commission disbands September 23 with almost universal agreement that Commission can take a bow for "job well done."

. . . General Services Administration surveying interest of other Federal agencies in Akron Government Laboratory. Disposal to industry dependent on value set on facilities by these agencies and willingness of industry to top this figure.

. . . Comparison of supply versus *demand for Technically Classified rubber from southeast Asia shows demand exceeds supply in the United States, but grades in greatest demand are in shortest supply.*

. . . Prices of tires and tubes and most other rubber products were increased 2-5% to compensate for higher labor and material costs.

Washington Report

Suez Canal Closing Would Temporarily Limit Supplies, Raise Natural Price, Strengthen Synthetic Demand

The Administration's great concern over the possibility of a major trade upheaval, if Middle-East tension brought closing of the Suez Canal, was centered in August on crude oil moving to the Western Hemisphere and western Europe. At the same time, however, government and industry rubber men were eyeing the possibility that a Suez shutdown would bring a drastic realinement in the rubber market as well.

Only Temporary Shortage

A canvass of interested Washington officials brought this general reaction: With almost 1½ million tons of dry rubber and latex moving northbound through the Canal annually, rerouting around the southern tip of Africa would bring only a temporary shortage in Western markets, but also an immediate rise in the price, reflecting both the higher costs of the longer voyage and the normal psychological effect experienced on all commodities affected by an international crisis.

Administration thinking on Suez presented a rather interesting paradox. It was made clear that plans to meet commodity shortages following the severing of this vital supply line did not envision the possibility of a war over Suez control. At the same time, however, the feeling was widespread here that Egypt would not close the Canal except by force. In other words, no one closely involved would consider the possibility of war, but, privately, it was assumed that only a war would bring a Canal shutdown.

On the question of rubber, two key factors mitigated against a shortage in this country: (1) the existence of a 60-day inventory in commercial warehouses; and (2) a competitive shipping situation from the Far East which found existing services scrambling for rubber cargoes. Some quarters felt that only a prolonged controversy at Suez would bring a tight shipping situation to this country, but that western Europe consumers would feel the pinch quicker and more sharply.

This size-up of the reaction to a Canal cut-off was supported by the figures showing movement of rubber and latex through Suez last year. Of the 1,349,000-ton total, 898,000 tons went to European markets; the rest to east and Gulf Coast ports in the United States, principally to New York. The conclusion was unanimous that forced use of the "round-the Horn" route over a long period would bring a sharp increase in European demand for American synthetics. Thus the domestic synthetic rubber industry, operating now at less than capacity and still expanding, would be called upon to face the greatest crisis since World War II.

As of the end of last year, capacity for styrene-butadiene (SBR) rubber was an estimated 1,030,000 tons (and still growing), but production thus far this year has ranged between an 850-950,000-ton annual rate. By the end of the year, capacity for SBR output will be within reach of the 1,200,000-ton mark (all figures include oil in oil-extended types).

Cost Considerations

Cost factors immediately affecting rubber moving the longer route around South Africa would include two major items: (1) cost of the 7-12 days' extra steaming time, spread over the entire cargo at the rate of between \$2,500 and \$3,000 daily; and (2) a possible increase in the cost of insurance (war risk). These costs alone could be expected to add a cent or two to the delivered cost, but this boost would probably be outweighed by the psychological reaction.

Reaction to the Canal seizure by Egyptian Premier Nasser, for example, was at least partly responsible for a 2¢ rise in the average price of No. 1 Ribbed Smoked Sheets over the week-end following the Nasser action of July 26.

"The Suez thing aggravated the price to beat the band," one rubber official here observed.

In a position to do little worrying about the Suez controversy was the government's

rubber stockpiler—the General Services Administration. With stockpile-growth buying at an end and purchases running only high enough to rotate aging supplies (about 7,500 tons monthly), GSA officials could comment:

"We have a very minor part. Closing of the Canal will have no impact whatsoever on the stockpile."

Ample Cargo Space

A Washington spokesman for the rubber industry likened the modern crisis to that dating back to 20 years ago when Italian Dictator Mussolini threatened to, then finally invaded Ethiopia, southwest of Suez. This spokesman recalled that war-risk insurance rates on ships moving through the Canal made it cheaper to take the long way around Africa. Even with the consequent delay en route, there was no serious dislocation in Western rubber markets.

Commenting on the present-day transportation system and its ability to handle the added stress of a Suez shutdown, he said: "There is more space on vessels serving rubber areas than there is cargo. There has been a terrific amount of throat-cutting among the steam lines competing for rubber."

Further, he said the traditional American and foreign lines active in this trade were facing new competition adding even more vessel capacity to that normally available — Japan merchantmen running south to the area then east, across the Pacific, to markets in this hemisphere.

GSA Surveys Federal Agencies Need of Akron Laboratory; Industry Bids Will Have to Top Agencies Price Tag

The General Services Administration was hard at work in August on the difficult task of disposing of the government's Synthetic Rubber Evaluation Laboratory and Pilot Plant in Akron, O. Responsibility for disposal was assigned to GSA by Congress after the National Science Foundation had unsuccessfully attempted to lease the installation to the University of Akron, through June 30, 1957. The only previous operator of the Laboratory, Akron University, stepped out of the picture at the end of June after declining with regrets the government's offer to lease the facilities for one year on a rent-free basis, as it could not afford the almost $1 million yearly in operating expense required.

Survey before Sale

At that point, NSF went to work on a proposal for outright sale, a proposal which Congress adopted shortly before it adjourned late in July. In so doing, however, Congress's Senate Banking and Currency Committee added a proviso or two which lend a definite touch of complication to the plan. Before voting out a disposal measure, the Senate Committee canvassed federal agencies active in chemical and engineering research to determine what use, if any, the government itself might have for the facility.[1]

The Department of Agriculture stated that its expanded program to find greater use for farm commodities could use the laboratory portion of the Akron installation unless the government could sell it at a price high enough to build a comparable facility specifically designed for research on farm products. Thus Congress insisted that the GSA poll the Agriculture Department and other interested government agencies and get them to put a price tag on the Akron facilities in terms of their own needs of research facilities.

Upon completion of the poll, GSA must go to private industry with an invitation to bid. This disposal program will be especially unique, therefore, because federal facilities are not normally disposed of if there is a need within the government. GSA must put the Akron facilities on the block, however, regardless of federal need.

When private industry bids, if any, are received, GSA will have the rather difficult job of weighing the offers for the entire installation against what any and all federal agencies say the laboratory alone is worth to them. Unless the best offer for the pilot plant and the laboratory tops the replacement cost of the laboratory, the government will retain title to the installation and make the laboratory available for federal research.

The final word on this question, however, will not be delivered by GSA. It will turn over its figures to the financial-fiscal experts at the Bureau of Budget and let them decide whether it is feasible to retain or dispose of the facilities. In the meantime, GSA spent the month of August inventorying the Akron facilities, getting the legal aspects clarified, and preparing the questionnaire for its poll of other agencies. The poll of federal agencies is being conducted in an atmosphere of secrecy to prevent a leak on how these agencies might evaluate the installation. Presumably, the Department of Defense and the Commerce Department (principally the National Bureau of Standards) as well as the Agriculture Department will be included in the survey.

NSF Research Commission Thanked

With GSA "in" and NSF "out" of the disposal program for the Akron facilities, Alan F. Waterman, NSF director, took time in early August to congratulate and thank the NSF Special Commission for Rubber Research for its contribution to the disposal task.[2] Among other things, he advised the 11-man group that the Administration had followed through on the Special Commission's advice of last December that the Akron installation be offered for sale after June 30, 1956, unless in the meantime the University of Akron accepted a lease, at a nominal fee, for use of the facility for the 12 months ending June 30, 1957.

"It occurred to me," Dr. Waterman wrote, "that the members of the Foundation's Special Commission for Rubber Research might be interested in a 'final report' on the action taken by the government to carry out the recommendation of the Commission in its report dated December, 1955. I believe that when the government abency persuades outstanding citizens to undertake time-consuming inquiry into difficult subjects in the face of already existing heavy demands upon their time and energy, the government owes them a report on the use which has been made of their advice and recommendations."

Dr. Waterman recalled that the Special Commission made three recommendations not directly involving the Akron facilities: (1) the Foundation's program of rubber research contracts should be terminated as of June 30, 1956; (2) the Foundation should initiate a program for support of basic research in the field of high polymers; and (3) the executive branch of the government should give careful consideration as to the action needed to insure an adequate production base for synthetic natural rubber in the event of an emergency.

"The Federal Government," he reported, "carried out these recommendations in the following way:

"(1) The 'rubber research program' of the Foundation, which had been taken over a year earlier from the Federal Facilities Corp., has been terminated. Rubber research contracts were closed out June 30, 1956. The NSF rubber research group, which was the organizational unit responsible for administering the rubber research program ceased to exist as of July 1, and its records were transferred to the Foundation's chemistry program.

"(2) The Foundation has already approved 17 grants in the amount of $687,000 for basic research in high polymers.[1] All of these grants, except one, are for periods longer than one year. Eleven grants totaling $537,000 were made to support scientists formerly engaged in the rubber research program. No grant was made to a private research firm whose proposal was adjudged to be of an essentially applied research character, and a small grant, one year, was made to the National Bureau of Standards as a transitional measure. As a part of its regular program the Bureau will secure its own appropriations for high polymer research for the fiscal year 1958.

"Included in the sum mentioned above the Foundation has made, or will make, its grants approximating $150,000 for research in high polymers to support scientists other than those formerly engaged in the rubber research program. To fund all of these grants, the Foundation plans to use $500,000 carryover funds from the rubber program, with the remainder of the funds coming from the regular appropriations of the Foundation. In the fiscal year 1958, high polymer research will be financed mainly out of regular funds available to the chemistry program of the Foundation.

"(3) The Office of Defense Mobilization and the Department of Defense will continue to give serious attention to the production base of synthetic natural rubber. The Department of Defense has placed orders for a limited quantity of tires made from the new rubber. In his message to the Congress dated April 30,

[1] RUBBER WORLD, Aug., 1956, p. 737.
[2] *Ibid.*, Jan., 1956, p. 536.

1956, and dealing with rubber requirements and resources, the President said in part: 'The Government has available a number of means for assisting industrial development and expansion where such aid is found to be essential to national security. It is not now expected that any unique measures, such as would require new legislation, will need to be taken with reference to the development of capacity to produce synthetic natural rubber.'

"In the above connection only one of the three companies having publicly announced synthesis of the new polyisoprene polymer applied for a certificate of necessity allowing accelerated tax amortization to cover the construction of development or production facilities for the new process. In this case the certificate was granted promptly. I think we can all be assured that the federal agencies concerned have their eye on this problem, and that continuing encouragement will be given the private industry to further this new technological development . . . .

"I believe that the executive branch of the government and the Congress have together taken action designed to carry out completely the letter and the spirit in the recommendation of Special Commission for Rubber Research. I am sure that I speak for all in the government who are concerned with rubber and rubber research when I express again our sincere appreciation for the outstanding public service rendered by the members of the Commission."

Dr. Waterman's letter went to Special Commission Chairman Wm. H. Davis, Davis, Hoxie & Faithfull; E. R. Gilliland, Arthur C. Cope, and Wm. A. W. Krebs, Jr., all of Massachusetts Institute of Technology; Farrington Daniels, University of Wisconsin; Joseph C. Elgin, Princeton University; Paul D. Foote, retired official of Gulf Research & Development Co.; David D. Henry, president, University of Illinios; Frank A. Howard, retired president of the former Standard Oil Development Co. of N. J.; and Warren C. Johnson and Lawrence A. Kimpton, both of the University of Chicago.

Rubber Producing Disposal Commission Disbands; Accomplishments Earn "Job Well Done" Commendation

The Rubber Producing Facilities Disposal Commission gets the well-deserved "decent burial" this month that its chairman recently said it had failed to get on three different occasions. On or about September 23 the Commission will formally turn over the administration of two lease agreements —its only remaining responsibility—to its successor agency. During the two years and 10 months since its first meeting, the Commission sold 24 synthetic rubber plants built by Uncle Sam and let the third to private industry on a lease expiring in the Spring of 1958.

On the day it goes out of business, the Commission will close out a rubber disposal program, dating from the end of World War II, which returned to the government more than $453 million and turned over to private industry the title to more than 50 facilities built since 1943. All but 27 were sold under Democratic administrations; the rest, with the exception of an alcohol-butadiene plant at Louisville, Ky., and related catalyst equipment at Baltimore, Md., still unsold, were sold by the Republican-appointed RPFDC.

The government's decision to get out of the synthetic rubber business, born under President Truman and matured under President Eisenhower, spurred creation of a new industry capable of producing 915,-000 tons of styrene-butadiene rubber (SBR) annually in 1955, which will increase that figure to 1,300,000 tons the end of 1957.

RPFDC 1953-56 Record

The segment of this history which carries the greatest significance in terms of the contemporary rubber industry is that covering the period August 7, 1953-September 23, 1956. Until the Summer of 1953 the government had disposed of only five major facilities (four styrene plants and one neoprene plant); the balance were relatively minor installations of the "fringe" category. With enactment of the Rubber Producing Facilities Disposal Act of 1953, approved by Congress in August, the Eisenhower Administration took on the chore of selling the 27-plant "core" of the synthetic network at a reasonable price, under competitive conditions and protective of the national security.

To handle this task President Eisenhower appointed three private citizens foreign to the rubber, chemical, or petroleum industries—all novices in the complicated research, production, and sales problems of these fields. They were, in the order of their subsequent responsibilities as commissioners: Holman D. Pettibone, former president of the Chicago Title & Trust Co., chairman; Leslie R. Rounds, Kennebunkport, Me., retired first vice president of the Federal Reserve Bank of New York, vice chairman; and Everett R. Cook, a Memphis, Tenn., cotton merchant and exporter, member. They met for the first time here on November 10, 1953, taking on the responsibility of denationalizing the giant synthetic rubber industry.

In the words of an official government appraisal of this three-man body, it stood between Congress and private business, charged with understanding the basic position of each and serving as an intermediary in ironing out conflicting views and developing a sound disposal program. The experiment was a success, as summed up in this "epitaph":

"The detail of techniques employed by the Commission may not be useful to other government agencies having responsibility for taking the government out of business, but the results accomplished afford encouragement to the view that when fundamental principles are understood, government and business can find workable solutions of difficult problems in a spirit of cooperation and constructive action."

Between mid-November, 1953, and January, 1955, the Commission and its small staff, headed by Chicago industrialist Eugene Holland, completed the sale arrangements on 11 SBR copolymer plants, eight petroleum-butadiene plants, two butyl rubber plants, one alcohol-butadiene plant, one styrene plant, and one DDM chemical plant. Subsequently the Commission completed a three-year lease on the alcohol-butadiene plant at Louisville and sold the SBR facilities at Institute, W. Va., and Baytown, Tex. Proceeds from these transactions totaled $284,848,000, some $25,-885,000 more than the total net cost to the government of the entire program.

The job was not easy. A play-by-play account of the 13 months following the Commission's organizational meeting makes it painfully clear that at times the entire program faced collapse, that negotiations were often tediously prolonged, and that eventual success came only with the deadline for all negotiations—December 27, 1954. On that date the Commission announced that 24 of its 27 plants had been sold; no bids had been received on the Institute plant; the Baytown bid had been rejected as too low; it was negotiating to lease the Louisville plant; and no sale had been transacted on 447 pressure tank-cars also offered in the program.

Congress Approves

The results got a mixed reception from Congress, including moves to overturn certain sales and others to reject the whole program, but the final roll call on disposal was decisive in both chambers. The Senate approved it 55-31; the House approved 283-132—and the job was done.

Formal transfer of the 24 plants to the private purchasers followed on a carefully arranged schedule from April 21 to 29, 1955. As the transfer documents were signed, purchasers paid the government the plant prices, plus cash for inventory items acquired, and took immediate possession. Within six months of the end of the original program, the Commission had sold the Baytown plant for $7,153,000 and the tank-car fleet for $2,279,700 ($25.86 per car less than it cost the government to build them during World War II). The Institute plant was later sold to Goodrich-Gulf Chemicals for $11,333,000.

The Commission's final report to Congress (exclusive of that on the Louisville plant to Union Carbide & Carbon Co., which was disapproved earlier this year) catches the full flavor of its accomplishments:

"The synthetic rubber industry, born as a government monopoly in the early anxious days of World War II, has passed to private ownership. The American concept of free enterprise has become a reality.

"Synthetic rubber remains at or near prices in effect under government ownership and operation. Purchasers of the plants are spending millions of dollars to expand production and improve quality. More jobs have been provided. The government will receive substantial corporate tax payments as a result of private operations. . . .

"The RPFDC, of three members appointed by the President to carry out the expressed policy of Congress—to dispose of the synthetic rubber making facilities under stipulated conditions—has served conscientiously for more than two years."

Pettibone, Rounds, Cook, and their aides can take a bow for a "job well done."

Supply *vs.* Demand—TC Rubber

An interesting comparison of supply *versus* demand for Technically Classified rubber from southeast Asia may be obtained by using the 1955 production figures in the *Rubber News Sheet*, Vol. I, No. 1, July, 1956, of the Secretariat of the International Rubber Study Group, and those resulting from a recent survey of demand conducted by The Rubber Manufacturers Association, Inc., in this country and published on page 579 of the July, 1956, issue of RUBBER WORLD.

The table below is compiled from the production figures in the *Rubber News Letter* and the last column of the previously published RMA survey report which gave the total stated demand by grade for the United States.

If it is assumed that the majority of the world supply of Technically Classified rubber in 1955 is represented by these figures from the areas indicated, then it becomes evident that since the demand figures are for the United States alone, the demand is actually much greater than the supply. The major difficulty is found, however, in the lack of conformity between the supply by grades and the demand by grades, at least for this country. The supply of #1 RSS at 62,356 tons is far in excess of the demand of 16,694 tons; while the supply of RSS Nos. 2, 3, 4, and 5, at 1,390 tons, is only a fraction of the demand of 42,155 tons. Similarly the Brown Crepes would be used to the extent of 34,967 tons, but the supply is only 3,408 tons.

SUPPLY *VS.* DEMAND FOR TC RUBBER

	Supply						USA Demand RMA Survey
	Malaya						
	Estates	Packers	Remillers	Sumatra	Viet-Nam, Cambodia	Total Supply	
RSS #1 & Air Dried Sheet	33,334	1,602		10,816	16,604	62,356	16,694 *200
RSS #2, 3, 4, 5		1,390				1,390	42,155
Pale Crepe	263					263	1,566
Brown Crepe	536		548	2,111	213	3,408	†34,967
Totals	34,133	2,992	548	12,927	16,817	67,417	95,582

* Air Dried Sheet only.
† Thin Brown Crepe, Thick Blanket Crepe, and Estate Brown, lumped together for the purposes of this comparison.

Safe Tire Campaign Set

Several segments of the tire and associated industries launched a nationwide campaign from September 17 to October 13 to get unsafe tires off the nation's highways.

Sponsors are the Inter-Industry Highway Safety Committee, with headquarters in Washington, D. C.; the National Tire Dealers & Retreaders' Association; The Rubber Manufacturers Association, Inc.; Tire Retreaders Institute; E. I. du Pont de Nemours & Co., Inc.; the American Rayon Institute; and the nation's tire companies, dealers, and service stations.

Under the coordination of the Inter-Industry Highway Safety Committee, the program will include an "old tire round-up," a school "Play Safe" week to emphasize safety on streets and school playgrounds, and a system of organized tire checklanes on tire-dealer property to focus attention on the need of replacing unsafe tires with safe ones.

The nationwide program will involve work with local civic groups and police departments by the tire dealers to publicize the need of replacing old tires; promotional material from the NTDRA on the theme, "Safe Tires Save Lives"; and special material furnished dealers by tire companies.

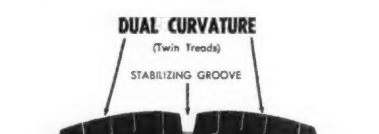
Du Pont, American Rayon Institute, and Tire Retreading Institute will promote the program through their own facilities.

Industry News

General Markets Twin-Tread, Extra-Strength Tire

The General Tire & Rubber Co. unveiled a new twin-tread, extra-strength nylon-cord, puncture-sealing tubeless tire, called the Dual 90, at a press conference in New York, N. Y., August 1. The tire was said to be the first in the history of the industry to be constructed with a dual curvature, that is, two distinct radii within each tire and two points of contact with the road instead of one. In addition, three-ply nylon cord, instead of two-ply nylon cord, is used in the carcass of the tire and results in an increase in strength of 38% more than that for conventional tires, and the puncture sealant is confined between two layers of rubber to prevent movement due to the centrifugal force on the tire at high speeds and avoid "bunching up" in the center of the tire.

The accompanying cross-sectional drawing shows the twin treads of the new tire and the stabilizing groove between them which gives flexibility to the center of the tire and allows the dual treads to work independently for better rolling contact. Stringent tests prove that the Dual 90's twin treads coupled with the dual curvature enable the tire to hold the road more firmly on both dry and wet and because of more uniform distribution of load to wear more evenly and at a slower rate than conventional single-tread tires. Road tests in Texas with the new General tire gave a loss of 0.090-inch at the center and 0.101-inch at the shoulder of tread rubber after 18,240 miles of high-speed driving, compared to 0.124- and 0.077-inch center and 0.156- and 0.143-inch at the shoulder for each of two competing tires.



Cross-section of General's Dual 90 twin-tread, extra-strength tire with two road contacts for extra safety

The twin-tread design as well as the composition of the tread rubber was reported to provide for a much improved noise level and freedom from squeal in comparison with other tires, improved traction on wet roads, slower tread wear, and safer driving.

The puncture-sealant construction called Strata-Seal is a laminated type consisting of two layers of sealant separated and walled in by layers of high-strength rubber which controls the movement of the cement while permitting a soft cement for maximum puncture-sealing characteristics.

Each Dual 90 tire contains 840 strands of three-ply nylon cord with 40 pounds of tensile strength each; while the carcass of most nylon tires contains about 840 strands of two-ply nylon cord with 27 pounds strength each; thus the 38% increase in overall carcass strength is achieved in the new tire, it was pointed out.

The result of two years of concentrated research and development at General Tire's Akron headquarters, this new premium-quality tire was designed for those who want the ultimate in safety and performance, according to L. A. McQueen, vice president in charge of sales for the company.

Eide Celebrates 40 Years with American Zinc

A. C. Eide, vice president and director of American Zinc, Lead & Smelting Co., Columbus, O., celebrated his fortieth anniversary with the company on August 1.

He joined American Zinc in 1916 as a chemist at Hillsboro, Ill. Three years later he was made branch manager at the firm's Chicago sales office and in 1923 was transferred to Columbus as sales engineer of American Zinc Oxide Co. He became manager of the pigment division of the company in 1940.

Mr. Eide was made vice president of American Zinc Oxide and of American Zinc Sales Co. in 1944. He was elected vice president of the parent company six years later. In 1954 he was elected to the board of directors of American Zinc, Lead & Smelting.

A prominent figure in the rubber and paint industries, Mr. Eide is an authority on the manufacture and use of zinc oxide. He is the author and co-author of several technical papers which deal with the use of zinc oxide.

A graduate of the University of Illinois with a B.S. degree in chemical engineering, he is currently a member of the American Chemical Society and of its Division of Rubber Chemistry and holds membership in the Akron Rubber Group, the American Ceramic Society, the American Society for Testing Materials, and other technical groups.

Baker Art Gallery

A. C. Eide

Price Increases Reported

The month of July saw the 1956 wage pattern set for the rubber industry with production workers being granted a 6.2¢-an-hour wage increase, plus fringe benefits amounting to about 3¢ an hour in most cases.

In August, companies in the industry adjusted their product price patterns upward by 2% on passenger-car tires and tubes, 2½% on agricultural tires and tubes, and 3½% on truck tires and tubes. Prices on industrial rubber goods including belting and hose were increased from 2½ to 5%. Increases on shoe-product items amounted to 3% and on rubber houseware items from 5% to 15%.

These price increases were necessitated by recent advances in the labor and material costs, it was said.

Announcements on these price increases were received from Goodyear, U. S. Rubber, Goodrich, Dayton, Seiberling, Hewitt-Robins, and Wooster Rubber. It is expected that this price pattern will become general for most companies in the industry.

Fifty-Year Mark Observed by Bridgwater Machine

A half century of existence is currently being celebrated by Bridgwater Machine Co., Akron, O., contract manufacturer for the tire, aircraft, railroad, and other industries. The firm has two divisions: Athens Machine Division, Athens, O., and Bridgwater Machine Co. (Canada), Ltd., Brantford, Ont.

Bridgwater was founded in 1906 by Harry H. Bridgwater and Freeman D. Mason as a small machine shop specializing in the machining and assembling, under contract, of components and complete units for other manufacturers.

Today, with its two divisions, the company claims to be one of the nation's largest, most completely equipped firms whose primary activity is contract manufacturing. The parent company's three former Akron plants are now consolidated in a single plant on Gilchrist Road, Akron.

President of Bridgwater Machine Co. is Boyd E. Bridgwater. Frank A. Buechler is vice president in charge of manufacturing, and John W. Bridgwater and James Steedman are treasurer and assistant treasurer, respectively.

Athens Machine Division is claimed to be the only plant in the world devoted exclusively to tire mold manufacture. The plant also makes the Bridgwater engraving machine for hydraulically controlled and powered, semi-automatic engraving of steel tire molds for passenger cars and trucks, and other types of engraving machines.

Officers of the Athens division are Wm. M. Mapes, vice president in charge of sales; Albert J. Slatter, vice president in charge of manufacturing; and Frank M. Batdorff, assistant treasurer.

Standard Oil Consolidation

Standard Oil Co. (Indiana) will consolidate three of its chemical subsidiaries later this year in order to "develop its chemical activities more aggressively and to increase sales and operating efficiency."

Indoil Chemical Co., Chicago, Ill., Pan American Chemicals Corp., New York, N. Y., and Amoco Chemicals Corp., formerly Hidalgo Chemical Co., Tulsa, Okla., will be consolidated into a new Amoco Chemicals Corp., with headquarters in Chicago. Jay H. Forrester will be president of the new entity.

The chemical consolidation is part of a recently announced functional reorganization of nine Standard Oil Co. (Indiana) subsidiaries into four.

Ameripol SN Passes Tests as Anti-Corrosion Liner

Ameripol SN, a synthesized natural rubber developed by Goodrich-Gulf Chemicals, Inc., is at least as effective in handling corrosive chemicals as the tree-grown product, according to Clyde O. DeLong, president of B. F. Goodrich Industrial Products Co., Akron, O.

With concentrated hydrochloric acid, for example, Ameripol SN forms a hard, continuous surface film that acts as a barrier to corrosion in the same way that crude rubber does, Mr. DeLong revealed. With some corrosive chemicals, Ameripol SN proved superior to crude rubber.

Mr. DeLong's conclusions were based on comparative tests run on metal-covered samples of Ameripol SN and crude rubber linings, and immersion tests conducted in accordance with methods prescribed by the American Society of Testing Materials (D471).

Goodrich-Gulf, owned jointly by The B. F. Goodrich Co. and Gulf Oil Corp., is now building a pilot plant in northern Ohio to produce Ameripol SN. The rubber has already been used in large truck tires and is said to be giving satisfactory performance in fleet operation.

"Based on tests run so far, we see no reason why Ameripol SN should not replace crude natural rubber as a corrosion resistant material in many applications in the lining field," Mr. DeLong further declared.

Cabot Scholarship Grants

Cabot Foundation, Inc., will this fall award scholarship grants to seven students in the fields of chemical, mechanical, and petroleum engineering, and geology at seven southwestern colleges as part of its nationwide scholarship program.

The Foundation, formed by Godfrey L. Cabot, Inc., Boston, Mass., and members of the Cabot family, has as its purpose the aiding of charitable, educational, religious, and scientific organizations. Grants to students are intended to help overcome the shortage of scientifically and technically trained people.

The schools selected in the current grants are Louisiana State University, the University of Texas, Texas Technological College, Southern Methodist University, Rice Institute, Texas Agricultural & Mechanical College, and Oklahoma Agricultural & Mechanical College.

Summer jobs with Cabot will also be offered the students to provide them with the opportunity to supplement their classroom education with on-the-job experience. Acceptance of the jobs is optional.

Smith Speaks at Sun's Thirty-Third Anniversary Fete

Thomas W. Smith, Jr.

Thomas W. Smith, Jr., president of Sun Rubber Co., Barberton, O., outlined his hopes for the future of the company during ceremonies marking Sun Rubber's thirty-third anniversary.

Speaking before 700 company employes on August 9, he said that the company's task is to expand sales and maintain the quality of its products so that it can share in the expanded growth of playtime sales which it is expected the next 10 years will bring.

Declaring that Americans are spending more time at play than at work, he said that since 1950 consumers have been buying strictly recreational goods and services at the rate of $10 billion a year.

The company is an important manufacturer of sporting goods, toys, and novelties, in addition to mechanical goods and druggists sundries.

To Boost Playtex Output

A $25,000,000 expansion program that is hoped will increase its annual sales from a current $40,000,000 to $120,000,000 within the next two years has been launched by International Latex Corp., Dover, Del., it was announced by A. N. Spanel, board chairman.

Additions to its production facilities at its main Dover plant are now being constructed, and a new plant is being built at Lafayette, Ala. Operations will begin shortly at a recently completed plant at Newnan, Ga. Within the past year new plants have been erected at Manchester, Ga., and in Puerto Rico.

International Latex, which markets its products under the Playtex label, is considered the soft goods industry's largest advertiser in printed media and plans to continue its current schedule without a budget decrease.

The company's labor force is expected to be increased in two years from its present 4,000 to 12,000 people. The sales staff, too, will be greatly augmented.

Probing Footwear Imports

The Canadian Government has announced its intention of examining the threat to the domestic rubber footwear industry posed by increasing imports of low-priced footwear. Representatives of the industry have for some time now been warning the government to restrict competitive imports or face the total extinction of the home industry.

Two companies, B. F. Goodrich Canada, Ltd., and Superior Rubber Co., recently halted production of footwear because of foreign competition. Unemployment has risen steadily throughout the remainder of the industry.

Spokesmen for the industry, citing one example of declining domestic sales, say that 71% of the canvas footwear bought by Canadian consumers during 1956 will be foreign products.

The export market has also waned during the past 10 years.

U. S. Rubber Warehouse

A $235,000 sales branch and warehouse will be built at Omaha, Neb., by United States Rubber Co., New York, N. Y. The structure will contain 33,000 square feet of floor space and will be located on a 47,000-square-foot plot. Present offices and warehouse facilities at two locations in Omaha will be supplanted. Completion of the building is expected next spring.

John J. Kelley is U. S. Rubber's Omaha branch operating manager.

General Latex in Canada

General Latex & Chemical Corp., Cambridge, Mass., will open its second Canadian plant on October 1. Located at Brampton, Ont., the plant will contain 16,000 square feet of floor space and will have fully integrated facilities for latex compounding and distribution, and a laboratory. The plant will be known as General Latex & Chemicals (Canada), Ltd.

Clayton Sturgeon will be plant superintendent, and Ronnie Perego will be chief chemist.

Canfield's 15,000th Mold

Its 15,000th mold has been ordered from its tool maker, H. O. Canfield Co., Bridgeport, Conn., manufacturer of molded rubber goods, now celebrating its sixty-eighth anniversary, has revealed.

The mold joins a long list of molds and tools that the company's own tool maker has manufactured for the aeronautical, automotive, electrical, home appliance, and plumbing industries, Canfield says.

The firm has subsidiaries at Clifton Forge, Va., and at Seymour, Ind.

Plant Maintenance Show

The next Plant Maintenance & Engineering Show will be held in the Public Auditorium, Cleveland, O., January 28-31, 1957, it has been announced by Clapp & Poliak, Inc., New York, N. Y., the exposition manager. The eighth in an annual series, the show is expected to have more than 400 exhibitors, the most in its history.

The annual Plant Maintenance & Engineering Conference will be held concurrently with the exposition. Hotel information and advance registration cards may be obtained from Clapp & Poliak.

New Gear-Hardening Unit

Equipment to induction-harden both spur and helical gears in diameters up to 157 inches and face widths up to 20 inches was recently installed at Farrel-Birmingham Co., Inc., Ansonia, Conn. The European-made machine is believed to be the first of its kind in this country.

The equipment is said to differ from most heat-hardening units in its ability to produce a case contour with the best combination of durability and bending strength.

Pitches from 5 DP to 0.75 DP can be handled with consistent results, Farrel-Birmingham says, because human factors are reduced to a minimum through the use of several effective and modern control features. The company expects to improve load-carrying capacity in relation to gear size without excessive cost.

Farrel-Birmingham's new gear-hardening equipment

Parker O-Ring Compounds

Parker Appliance Co., Cleveland, O., recently announced that its rubber research and development laboratory has formulated hydraulic O-ring compound 47-761 to meet requirements of specification MIL-P-18017 A, covered by drawing MS-28784. The research work was especially aimed at a better material at −65° F. The material was also given the additional test of being soaked in low swell oil for seven days at 160° F. This test is not included in the specification, but is used by several major aircraft manufacturers as a qualification.

Parker has also found that its O-ring compound 77-018 meets the requirements of SAE specification AMS-3357, which calls for a silicone material that has lubrication oil resistance, good compression set, and is suitable at a range of —65 to 450° F.

New Stillman Warehouse

An 8,000-square-foot, two-story office and warehouse building has been built by Stillman Rubber Co., manufacturer of custom molded parts and packings, Culver City, Calif., alongside its existing plant. The structure is part of an expansion program that will increase the firm's production capacity by 30%, according to C. T. Erickson, executive vice president.

Stillman did its own contracting and construction on the building and prepared architectural specifications.

Molder of Colored Rubber

Minnesota Rainbow Rubber Co., Minneapolis, Minn., wholly owned subsidiary of Minnesota Rubber & Gasket Co., began operations on July 1 as a producer of custom-molded rubber parts from colored materials.

The new firm has a one-story brick building that was designed to prevent contamination of the colored products from the black carbon used in normal rubber processing.

President of the company is Robert W. Carlson, who is also vice president and treasurer of the parent organization. Richard Mueller is plant manager, and Richard G. Wells is sales manager.

The company will establish regional sales offices in New York, Philadelphia, Chicago, Cleveland, Detroit, Milwaukee, St. Louis, Denver, Houston, Los Angeles, and Portland, Oreg.

Sun Rubber Names New Production, Sales Committee

Charles Rippey

Albert Nylund, Jr.

Sun Rubber Co., Barberton, O., has named an eight-man executive committee and two new vice presidents "to help spearhead an expanded program of production and sales."

T. W. Smith, Jr., president of the firm, will be chairman of the executive committee, whose other members will be S. C. Andress, secretary of the company; W. S. Raymer, vice president and controller; William R. Lantz, vice president and merchandise manager; T. B. Roberts, vice president, sales; Ray D. Page, a director; Albert Nylund, Jr., vice president, manufacturing; and Charles Rippey, vice president, technical division.

Nylund and Rippey are the two new vice presidents. Mr. Nylund formerly served as vice president of a large manufacturer of prefabricated housing. Mr. Rippey was previously chief engineer of subsidiaries of The Firestone Tire & Rubber Co. in Sweden and Argentina.

Appointed to serve with Mr. Rippey's technical divisions are Paul Rekettye, as chief engineer in charge of mechanical design and processing; C. E. Draper, as technical director of rubber operations; Vaughn Valentine, as technical director of vinyl operations; and Dean Widrig, as plant engineer in charge of maintenance, construction, and shop facilities.

Unite BFG Aero Sections

Manufacturing and selling functions of B. F. Goodrich aeronautical departments have been combined into a single operating division to be known as B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Co., it has been announced by J. W. Keener, executive vice president.

P. W. Perdriau and E. H. Fitch have been appointed general manager and general manager-sales, respectively, of the newly created division. Also named were C. B. McKeown, to general manager, rubber products manufacturing; J. H. Seaton, to general manager, wheel and brake manufacturing; and W. D. Matthews, to treasurer.

Kel-F Prices Cut Severely

The price of Kel-F fluorocarbon plastic molding resins has been reduced by as much as $2.50 a pound, to $6.00 a pound in large quantities, by its manufacturer, The M. W. Kellogg Co., New York, N. Y.

Calling the cuts the biggest price reduction of the year in the plastics industry, Walter J. Merck, manager of sales for Kellogg chemical manufacturing division, said the lower prices have been made possible by an increasing acceptance of Kel-F plastics throughout industry.

The new price schedule applies to both high- and low-density grades of the molding powders.

Plant of the new Minnesota Rainbow Rubber Co.

Distributes Wetting Agents

Aquadyne and Hydrodyne, wetting agents for the rubber and other industries, have been added to the distribution line of Whittaker, Clark & Daniels, Inc., New York, N. Y. The products are manufactured by Aquadyne Corp., Clark, N. J.

Aquadyne is in solid capsule form for use in proportioning devices to provide on-the-spot generation of wet water. Hydrodyne is a liquid concentrate for proportioning by hand or through devices.

Firestone Expanding SBR Facilities by 40,000 Tons

A 40,000-ton expansion of synthetic rubber production facilities at Lake Charles, La., has been announced by The Firestone Tire & Rubber Co., Akron, O. The new facilities, expected to be completed in December, will raise capacity at the plant to 190,000 long tons annually.

The plant had a design capacity of 99,600 long tons when it was purchased from the government 15 months ago. This plant is now producing at a rate of 150,000 tons a year.

When the Lake Charles expansion is completed, Firestone, already the world's largest producer of synthetic rubber, will have the capacity to produce 230,000 tons of synthetic rubber annually. The company's second synthetic rubber plant, in Akron, produces 40,000 tons a year.

Firestone is also currently planning a petrochemical center in Orange, Tex., which will include a plant to manufacture 40,000 tons of butadiene a year. The company now makes about 25 types of synthetic rubber in solid and liquid form. These are used in making Firestone's own tires, as well as other products, and are also sold to other rubber manufacturers.

Seiberling: Nayed Proxy Bill Cause of New Lamb Blast

J. P. Seiberling, president of Seiberling Rubber Co., has accused Edward O. Lamb of renewing his criticism of the management of the company because the board of directors had refused to pay a bill of almost $55,000 for expenses incurred by the Toledo businessman in his recent unsuccessful fight to acquire control of the Akron, O., firm.

In a three-page letter to stockholders, Mr. Seiberling said that J. H. McGrath, a Lamb associate and a Seiberling director, had presented Mr. Lamb's bill of $54,981.48 at a board meeting and asked that it be honored. Mr. McGrath is reputed to have said "things would go much more smoothly in future meetings" if the directors would go along with his resolution that the bill be paid.

The resolution was defeated. Mr. Lamb subsequently released a "minority report" in which he attacked a voted salary increase for officers of the company, said the firm was having financial troubles and was in danger of being taken over by the banks, and criticized other recent actions of management.

In the stockholders letter, Mr. Seiberling defended the salary increase for himself and the other officers of the company and termed Mr. Lamb's statement about the financial position of the firm as "ridiculous and destructive."

After countering other of Mr. Lamb's criticisms, Mr. Seiberling said the board of directors was "anxious to get on with the business of building and strengthening Seiberling Rubber Co." and expressed the hope that the Toledo financier would "accept the fact that it is to his own best interests, and those of other stockholders, to let us do so."

Oust O'Sullivan Chairman

Vincent A. Catozella, president and chairman of the board of O'Sullivan Rubber Corp., Winchester, Va., has been removed from office and replaced, the company revealed. He will remain, however, as a member of the board of directors.

J. C. Herbert Bryant was named to succeed Mr. Catozella as board chairman. The new president of the firm has yet to be appointed.

The company denied there was any connection between Mr. Catozella's ousting and the fact that 400 of O'Sullivan's maintenance and production workers, members of the AFL-CIO United Rubber Workers Union, have been on strike since May 13.

Wellco Affiliates in Nigeria

Welco-Ro-Search, Waynesville, N. C., has concluded an affiliation agreement for a footwear factory in Nigeria, West Africa, which will have an initial production of 1,000 pairs of shoes with sponge rubber soles and 1,000 pairs of tennis shoes daily.

H. W. Rollman, president of Wellco-Ro-Search, said that production and consumption of footwear in Africa will increase at a very slow rate, since the majority of Africa's 200 million people cannot afford footwear.

BFG Canada Expansion

A $400,000 addition to its roll covering and tank lining departments has been announced by B. F. Goodrich Canada, Ltd., Kitchener, Ont. The new structure, when completed in early 1957, will add 10,000 square feet of floor space to the departments, M. G. Morgan, vice president, manufacturing, revealed. The addition will permit the handling of 30-ton rolls, the largest projected for use in Canada.

In line with its current expansion plans, the company also said it was preparing construction for a $1,225,000 headquarters building to be built on a 12-acre tract of land close to the boundary between the twin cities of Kitchener and Waterloo, Ont. The structure will contain offices and new warehouse facilities.

Rubber Mats for Cows

Farm Journal, Philadelphia, Pa., in a recent issue reported on a project of the University of Massachusetts dairymen which involved giving dairy cows rubber mats on which to sleep. The consensus of opinion was that rubber insulation between cow and concrete, with or without bedding, provided protection for teats and udders; cows slipped less; and only half as much bedding was required with rubber mats.

G-E Irradiated Polyethylene

Parts fabricated from a carbon black-reinforced irradiated polyethylene are being produced experimentally by the chemical development department of General Electric Co., Pittsfield, Mass.

The vulcanized reinforced polyethylene, known as Vulkene 107-E, is a black, tough, flexible plastic with physical properties and heat and chemical resistance said to be superior to those of conventional high-pressure polyethylene.

According to G-E, the yield strength at low temperatures for Vulkene 107-E is double that of polyethylene; while creep deformation is reduced about 10%. The new material shows long-term heat stability in hot air and boiling water.

Owing to its cross-linked structure, Vulkene 107-E can reportedly be carried to its decomposition temperature without melting. At 300° F. it retains a tensile strength of 500 psi.

Other cited virtues of the irradiated polyethylene include outstanding resistance to chemicals and inorganic acids, elimination of stress corrosion cracking, and high electrical conductance.

The company is presently test marketing a modification of the new polyethylene as semi-conductor tape in shielded power cable.

Latex Reactors Cleaned

A new technique for removing adhered latex from reactors in synthetic rubber plants, said to involve high-pressure water-jetting, has been announced by Solvent Service, Inc., Painesville, O., specialist in the hydraulic and chemical cleaning and descaling of industrial equipment.

The method, performed by the company's technicians, removes latex from reactor walls, coils, and agitators in four to six hours, according to Solvent Service. Conventional cleaning methods are said to compel the shutting down of reactors for as long as a week.

Rubber-Metal Permadizing

A rubber-to-metal bonding process developed by Stillman Rubber Co., Culver City, Calif., provides "steel-smooth" sealing surfaces for shut-off valve primary piston seals installed on aircraft fuel valves, the company reveals.

Called Permadizing, the process enables the piston seals, formerly three-piece units, to be redesigned as a one-piece part, eliminating time-consuming hand assembly and costly threading, according to the company. The seal is said to provide an optically smooth sealing surface, assuring perfect sealing even at near-zero pressure.

Listing other advantages of the process, G. W. Van Cleve, Stillman vice president of sales, said it reduces damaging swell, permits dimensional tolerances of materials as fine as metal, results in flash-free precision parts, reduces rejects due to improper bonding, and gives high resistance to aromatic fuels and hydraulics fluids. Technical details of the process were not disclosed.

Boosting Butadiene Output At Port Neches by 50%

A multi-million-dollar expansion program to increase the output of the Port Neches, Tex., butadiene plant by 50% to 300,000 short tons annually has been announced by William P. Gee, president of Texas-U. S. Chemical Co.

Full production from the new facilities is scheduled for the Fall of 1958, with some of the increased production to be realized in late 1957. The plant had a rated production capacity of 190,000 short tons when it was bought from the government in May, 1955, for $53,000,000.

The butadiene plant, the world's largest, is equally owned by Texas-U. S. and Goodrich-Gulf Chemicals, Inc. Both will participate in the expansion program. A portion of the butadiene output will be supplied by pipeline to two adjacent synthetic rubber producing plants owned by these companies; another portion will go to other rubber and chemical producers.

Mr. Gee said that the Port Neches expansion will help relieve the current shortage of butadiene. He also pointed out that many new uses are envisioned for butadiene in new synthetic polymers and in new petrochemical products.

Borden Buys Pioneer Latex

Pioneer Latex & Chemical Co., Middlesex, N. J., manufacturer of protective coatings and other latex and rubber products for the textile, flooring, and adhesives industries, has been acquired by the chemical division of Borden Co., New York, N. Y., and will be merged with its Resinous-Reslac department. The merged units will be known as Resinous-Reslac-Pioneer.

Stephen G. Paliska, president of Pioneer since its inception, will become assistant general manager of the Resinous-Reslac-Pioneer department. Ashworth N. Stull of Borden's Peabody, Mass., plant, will continue as general manager.

In addition to its Middlesex plant, Pioneer has interests in two foreign firms, Placco Puerto Rico and Placco Colombiana Ltda.

Conveyor Helps Float Ship

An ore boat, sunk in 32 feet of water in the St. Clair River in the Great Lakes area, recently was salvaged through the use of a rubber belt conveyor, according to The Goodyear Tire & Rubber Co., Akron, O., whose belt was used.

The salvage crew made a giant collision pad of conveyor belt strips fastened together with regular belt fasteners. The collision pad measured 20 by 30 feet and was backed by a network of steel cables. Divers attached the pad to the caved-in side of the sunken ship.

Water was pumped from the ship. It rose to the surface and was towed to shore, with the improvised pad holding back the water.

Smaller Tire on New Cars

About 70% of 1957-model automobiles will be equipped with 14-inch tires, according to E. F. Tomlinson, president, B. F. Goodrich Tire Co., Akron, O. The smaller-size tire will meet public demand for tires that match the higher horsepower and longer, lower styling of the new cars, he said. The 14-inch tire will have 22 pounds of air pressure and will have a load carrying capacity about equal to that of the 15-inch casing because of a 10% wider section width.

John T. Dunn

Dunn Named by Thiokol

John T. Dunn has been appointed head of the new butyl sales-service organization of Thiokol Chemical Corp., Trenton, N. J. The company will market butyl rubber in collaboration with Petroleum Chemicals, Inc., which is owned jointly by Cities Service Co. and Continental Oil Co.

Mr. Dunn was formerly manager of belting, hose, packing, and tape sales for Dominion Rubber Co., Ltd., the Canadian affiliate of United States Rubber Co. He has also served the company in the capacity of rubber compounder, development engineer, and technical service engineer. He holds a degree of chemical engineering from the University of Toronto.

In addition to the marketing of butyl, the Thiokol sales-service organization will seek the development of wider uses for butyl rubber and will assist consumers in its choice and utilization.

Petroleum Chemicals is licensed by Esso Research & Engineering Co. to manufacture butyl. It currently operates a butadiene plant at Lake Charles, La.

Hooker, Durez Office Tie

Consolidation of district sales offices of Hooker Electrochemical Co., Niagara Falls, N. Y., with the Durez Plastics Division and the Niagara Alkali organization has been completed, it was announced by Robert E. Wilkin, Hooker vice president and director of sales.

He said the various sales offices of Durez will continue to operate as a divisional entity even though physically housed with the chemical sales offices. Headquarter sales offices for chemicals will continue to be at Niagara Falls, and for plastics at North Tonawanda, N. Y.

Hooker and Durez now occupy combined branch sales offices at 3325 Wilshire Blvd., Los Angeles, Calif.; at 60 E. 42nd St., New York, N. Y.; at the former Niagara Alkali administration building, Niagara Falls, N. Y.; and at 1 N. LaSalle St., Chicago, Ill.

The Durez and Hooker advertising staffs have also been united at Niagara Falls.

Firestone Brazil Plantation

A rubber plantation that will initially extend over 3,000 acres in eastern Brazil, the country where the rubber tree originated, is being established by The Firestone Tire & Rubber Co., Akron, O., it has been revealed by Byron H. Larabee, president of Firestone Plantations Co.

Within six years the first trees will be yielding latex to be tapped by the vanguard of a permanent work force of 1,000, Mr. Larabee said. The plantation is being established on a 12,500-acre tract of land near Itubera. Firestone has a large tire manufacturing plant in Sao Paulo, 1,400 miles to the south.

More than 700 acres have been cleared and some planted since the land was surveyed for Firestone in early 1954. Rubber trees will be transplanted from the company's plantations in Liberia, West Africa.

A rubber processing factory, where liquid latex will be preserved for shipment or coagulated and processed into sheet rubber, will be built across the Rio Serinhaem, which bounds one section of the plantation.

Bert O. Vipond, formerly plantation manager of the company's Liberian plantation, will be general manager of the new plantation.

Goodyear Venezuelan Plant

P. W. Litchfield, board chairman of The Goodyear Tire & Rubber Co., Akron, O., officially inaugurated the company's newest tire plant at Los Guayos near Valencia, Venezuela, at ceremonies on August 14. Full production at the plant is expected before the end of the year.

Mr. Litchfield inspected the single-story structure and made the dedicatory address. Accompanying him was G. K. Hinshaw, Goodyear vice president and production manager of foreign operations. Venezuelan government officials also were present at this affair.

The plant will turn out a full range of passenger and truck tires and tubes, as well as a line of hose designed for the oil industry.

News About People

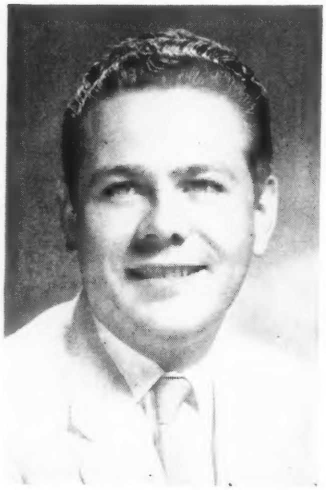
Fred N. Lehmann, staff superintendent of B. F. Goodrich Tire Co., Akron, O., has been advanced to Akron tire plant superintendent.

Edward J. Shages has been named vice president and manager of the cutting tool and gage divisions of Pratt & Whitney Co., Inc., West Hartford, Conn.

Robert F. Connelly has been assigned as the West Coast field salesman for the organic chemical sales department of Emery Industries, Inc., Cincinnati, O.

Grover C. Shuman has become staff superintendent of the Akron, O., tire plant of B. F. Goodrich Tire Co.

Edward S. Coe, Jr., vice president and a director of Farrel-Birmingham Co., Inc., has been appointed general manager of the firm's Consolidated Machine Tool Division, Rochester, N. Y., succeeding **Lester D. Chirgwin,** who will retire. Mr. Coe is succeeded as manager of Farrel-Birmingham's Ansonia and Derby, Conn., plants by **Graham Hassard. Richard D. Mace** becomes manager of foundries and is succeeded as New England sales representative by **G. Wells Eighmy, Jr. Gould C. Christensen** has been named F-B's lower Michigan sales representative.



Robert F. Connelly

John A. Raggio

John A. Raggio, eastern sales manager for Pioneer Products Division of Witco Chemical Co., New York, N. Y., has been named general sales manager of the Division, with which he has been associated 18 years, operating in both sales and purchasing.

Edward S. Coe, Jr.

Walter H. Kuhlen

Mrs. Goldie W. Rimson, Arthur T. Schooley, and **Edward J. Mendyka** have joined the staff of the B. F. Goodrich Co. Research Center, Brecksville, O., as chemical librarian, technical man, and chemist, respectively. Added to the staff as junior technical men were **Michael J. Geregach, Robert F. T. Sterbenz,** and **Jerrold A. Glantz.**

H. H. Kieckhefer has been appointed sales manager of the Wheelco Instruments Division of Barber-Colman Co., Rockford, Ill. For the past several years he was assistant sales manager for the Division.

Walter H. Kuhlen has been appointed technical sales representative to the Pennsylvania, New York, and southern area territories for Marbon Chemical, division of Borg-Warner, Gary, Ind.

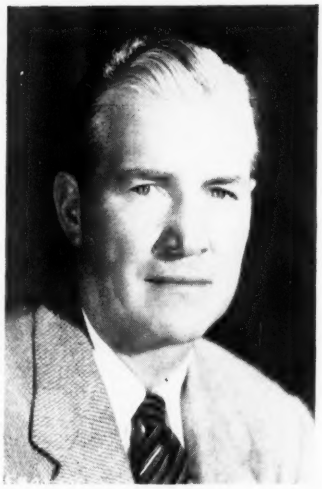
Russell L. Haden has been advanced to general manager of the organic chemicals division of Dewey & Almy Chemical Co., Cambridge, Mass.

Thomas H. Smith has been named manager of the chemicals and pigments purchasing department of The B. F. Goodrich Co., Akron, O.

A. W. Low has been named director of overseas manufacture for the plastics division of Monsanto Chemical Co., Springfield, Mass., and has been succeeded as director of engineering by **Francis E. Reese,** formerly associate director of engineering. **Carl T. King** will retire as manager of overseas plastics manufacture after 31 years of service with the company and will be succeeded by **M. O. Debacher,** now assistant manager of overseas manufacture. Also within the division, **H. K. Eckert** has been put in charge of West Coast and Texas City, Tex., manufacturing operations; while **Carl E. Pfeifer** has been put in charge of the Trenton, Mich., Saflex plant.

Karl P. Herbruck, vice president and general manager of The Wilson Rubber Co., Canton, O., has retired after 34 years of service with the firm. He will continue to act as a director and consultant to the company.

O. E. Miles, general manager of the retail stores division, Goodyear Tire & Rubber Co., Akron, O., has been named to the newly created post of sales manager-tire division; while **R. W. Fitzgerald,** manager, tire sales, has been assigned the new position of general merchandising manager.



R. W. Maney

R. W. Maney has been appointed vice president and general manager of The Goodyear Tire & Rubber Co. of California, Los Angeles, Calif. He joined Goodyear in 1929 and has held important positions in production and sales. For the past year he was general manager of the California company.

Delbert J. Massey has been advanced to project specialist in the development department of the organic chemicals division of Monsanto Chemical Co., St. Louis, Mo. He will be assigned to Philip E. McIntyre, manager of the department, at the company's Nitro, W. Va., facilities.

Guy Gundaker, Jr., has been elected vice president, replacement tire sales, and **J. T. Callahan** has been elected vice president, equipment sales, of B. F. Goodrich Tire Co., Akron, O.

Hector Lazzarotta has been appointed a sales representative of Polymer Corp., Ltd., Sarnia, Ont., Canada. Formerly in the technical service and research laboratories at Polymer, he replaces **D. Seymour,** who resigned from Polymer to join Wooster Rubber of Canada, Ltd., Cooksville.

Max F. Moyer has been made manager, service sales and equipment division, tire departments, Goodyear Tire & Rubber Co., Akron, O. Formerly assistant manager, auto tire sales, Moyer replaces **L. W. Moore,** now general manager of the firm's retail stores division.

Chester T. Morledge has been named general manager, special brand sales, of the B. F. Goodrich Tire Co., Akron, O. Morledge, who has been with the Goodrich organization since June, 1936, most recently served as general manager, merchandising, Goodrich Tire.

Ernest Schleusener has been elected vice president, treasurer, and a director of Rodney Hunt Machine Co., Orange, Mass.

Arthur B. Bush has been appointed manager of the sundries department, B. F. Goodrich Industrial Products Co., Akron, O., and **Richard A. Lord** is field sales manager. Bush has been with the company since 1940, mostly in purchasing and sales; while Lord has been in sales with BFG for 18 years.

Domenic A. DiTirro has joined Valvair Corp., Akron, O., as manager of research and development.

Domenic A. DiTirro

Leslie G. Boatright has joined Escambia Bay Chemical Corp., New York, N. Y., where he will participate in the activities of the commercial development department.

Edward J. Fredericks has been named assistant sales manager of the automotive division of The Wooster Rubber Co., Wooster, O. **Jay B. Harris** has been appointed sales manager of the firm's specialty division.

Charles Hart has replaced **A. Reinhardt** as factory superintendent of Midwest Rubber Reclaiming Co., East St. Louis, Ill. **Howard Irwin** continues as general manager of West Coast operations.

Warren Carter has joined Gutta Percha & Rubber Co., Ltd., Toronto, Ont., Canada. He was formerly with Canadian Sponge Rubber Products Co., Waterville, P.Q.

Stuart Roesler, vice president and a director of Empire Trust Co., has been elected to the directorate of The H. O. Canfield Co., Bridgeport, Conn. Mr. Roesler is also on the boards of The Pantasote Co., Virginia-Carolina Chemical Co., Lithium Corp. of America, and Kawecki Chemical Corp.

Arthur J. Burke and **William Hamilton** have been advanced to vice presidents of Richardson Scale Co., Clifton, N. J.

Earl A. Hensal

Earl A. Hensal last month was named production vice president of Seiberling Rubber Co., Akron, O., to succeed **Harry P. Schrank,** now executive vice president of the company. In his new position Mr. Hensal, who previously had been factory superintendent of The B. F. Goodrich Co. tire and equipment plant in Akron since 1954, will have charge of engineering, production, development, and purchasing operations at Seiberling.

Harold W. Burkett, treasurer, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y., has been elected secretary of the Buffalo Control of the Controllers Institute of America. Elected director of the Iowa Control was **Lewis F. Jolly,** treasurer, Armstrong Rubber Mfg. Co., Des Moines, Iowa; of the Cleveland Control, **Claude A. Pauley,** comptroller, The Firestone Tire & Rubber Co., Akron, O.; and of the Bridgeport Control, **E. L. Worfolk,** treasurer, Sponge Rubber Products Division of The B. F. Goodrich Co., Shelton, Conn.

John J. Kenny has been elected assistant treasurer of Crown Cork & Seal Co., Inc., Baltimore, Md.

Cliff Hutter has joined the technical staff of Stoner Rubber Co., Anaheim, Calif.

Curt Wolters has resigned from Los Angeles Standard Rubber Co. to accept a position with Shalda Mfg. Co., Burbank, Calif.

E. M. Mayeau has resigned as chief chemist of Mansfield Tire & Rubber Co., Oakland, Calif., to join the technical staff of Master Processing Corp., Lynwood, Calif.

Kyle W. Charlton has been promoted to operating supervisor of the polyester department of Mobay Chemical Co., New Martinsville, W. Va. He succeeds **Elwood E. Martin,** who has been transferred to Monsanto Chemical Co., St. Louis, Mo.

Pach Bros.

Howard N. Hawkes

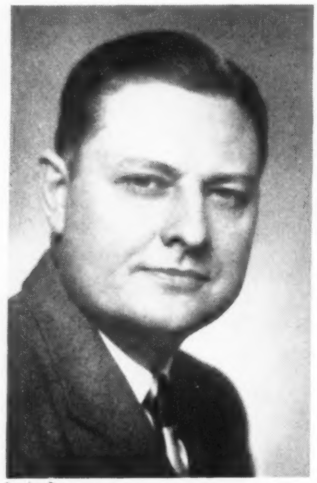
Howard N. Hawkes, vice president of United States Rubber Co., New York, N. Y., has been elected a director of the company and a member of its executive committee. He has been succeeded as general manager of the tire division by **G. Raymond Cuthbertson**, who has also been elected a vice president of the company. Both men are veterans in the U. S. Rubber organization. Mr. Hawkes, whose entire service has been in sales, started with the company in 1912 as a tire salesman; while Mr. Cuthbertson, most recently assistant general manager of the tire division, began his career in 1936 as a research chemist.

William H. Poisson has been appointed technical sales representative for Caprolan deep-dye and Caprolan tensile-tough nylon by National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y. Mr. Poisson was formerly New England representative for Caprolan, in which capacity he has been succeeded by **Robert E. Mulcahy.** Other additions to the Division's fiber sales and service staff are **Joe H. Christian**, now sales representative for Caprolan, assigned to the Greensboro office; and **Fabian P. Barch** and **Harry A. Greene,** recently assigned to the fiber application laboratory as textile technicians at the company's Chesterfield Plant, Hopewell, Va.

John C. Garrels, Jr., assistant general manager in charge of manufacturing for the plastics division of Monsanto Chemical Co., Springfield, Mass., has been made assistant general manager in charge of marketing, research, manufacturing, engineering, and personnel relations of the division. Garrels, who started with the company in 1942 as a chemical engineer, will help administer a divisional organization which operates six manufacturing plants, four research laboratories, and ten district sales offices.

Philip B. Stull has been elected a director of American Enka Corp., New York, N. Y. Mr. Stull is also a vice president and a director of Hercules Powder Co.

Robert H. Dhonau and **Arthur R. McDermott** have been added to the staff of the development and service department of Emery Industries, Inc., Cincinnati, O., and will be concerned with the development of all new Emery products as well as technical service for both the fatty acid and organic chemicals sales departments. Mr. McDermott previously had handled the sale of Emery's industrial chemicals first in the Chicago area and then in the southwestern states. Mr. Dhonau for the past 10 years was a member of the applications research group of the company's research laboratories.



Pach Bros.

G. Raymond Cuthbertson

Daniel T. Sigley, one of the nation's leading guided missile scientists, has been named chief engineer for the guided missile division of Firestone Tire & Rubber Co. of California, Los Angeles. He replaces Capt. **Frank MacDonald,** USN, retired, who has been made director of the firm's newly established engineering laboratory at Monterey, Calif. Dr. Sigley will direct the company's engineering, both electronic and mechanical, on advanced weapon systems.

W. D. Shilts, who joined The Goodyear Tire & Rubber Co. in 1905 in its sales organization and rose to the office of secretary of the company, which post he held 27 years, recently retired from the company. Suitable farewell ceremonies honoring him were held by his associates, at which he received several gifts. Traveling will play a big part in his retirement plans.

John K. Cochran has been named manager of production for the fiber glass division of Pittsburgh Plate Glass Co., Pittsburgh, Pa. He previously had been vice president and general manager of Duplan Corp.

Fred Owen, formerly with Goodyear Tire & Rubber Co., is now in the development department of W. J. Voit Rubber Corp., Los Angeles, Calif.

Underhill Studio

James E. Shand

James E. Shand has been appointed assistant manager, chemical sales, Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. to succeed the late **Richmond C. Quartrup.** Mr. Shand entered Barrett's employ in 1946 as a member of its technical sales service group and served successively as special representative, assistant sales manager, and assistant to the manager of chemical sales.

L. Marshall Welch has been appointed director of research, Petro-Tex Chemical Corp., Houston, Tex. Dr. Welch has been in charge of petrochemical research for the central research laboratory of the chemical divisions, Food Machinery & Chemical Corp., and will continue to have responsibility for these activities. To provide for its expanded petrochemical research activities, Petro-Tex is erecting a new research laboratory and executive office addition at its Houston plant.

Charles Schaef, Mrs. M. K. Myers, and **Richard H. Backderf** have joined The B. F. Goodrich Co. research center at Brecksville, O., as technical men. Also added to the Brecksville Staff were: **Kenneth F. Gill,** as a technical man in chemistry research; **John F. Anderson,** as a research chemist in adhesives; and **Norman E. Ernstein,** as a chemical engineer in the high-pressure laboratory.

Richard D. Dunlop has been appointed executive assistant for manufacturing for Monsanto Chemical Co., St. Louis, Mo. He will assist Felix N. Williams, the functional vice president-manufacturing, with his duties, giving particular emphasis to field contacts with manufacturing and all phases of engineering other than engineering research. Mr. Dunlop has been with Monsanto since 1927, most recently as assistant general manager of the company's plastics division.

John H. Lambert has been appointed sales representative for industrial resins sales for the Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

Charles Mayer Studios

B. Harding Miller

B. Harding Miller, since 1951 manager of the Akron, O., branch of George Woloch Co., Inc., New York, N. Y., has been named a vice president of the firm. Mr. Miller has been in the rubber and plastics business continuously since 1938, except for a three-year stint in the U. S. Air Force.

J. W. Keener, executive vice president of The B. F. Goodrich Co., Akron, O., has received the Department of the Army's highest civilian award for his contributions to a committee which advised the Army on its world-wide civilian personnel management program.

L. J. Macdonald, E. I. du Pont de Nemours & Co. of Canada, Ltd., has been elected chairman of the Quebec Rubber & Plastics Group. Other officers of the Group for the 1956-57 season are: **G. C. Stinson,** Northern Electric Co., Ltd., secretary; and **R. A. Howie,** Dominion Rubber Co., Ltd., treasurer.

M. F. Fitzgerald, plant manager for B. F. Goodrich Sponge Products Canada, Ltd., Waterville, P.Q., has been advanced to vice president and general manager. **H. V. McMurray,** sales and advertising manager, has been named plant manager and will continue as advertising manager.

Otto L. Schellin has been appointed union relations representative in B. F. Goodrich Tire Co., Akron, O.

Thomas J. Cook has been advanced to manager of engineering of B. F. Goodrich Tire Co., Akron, O. He was previously plant engineer at the company's Los Angeles, Calif., tire plant.

John C. Virden has been elected a director of The Goodyear Tire & Rubber Co., Akron, O. He is chairman of the board of directors of the Federal Reserve Bank of Cleveland and of the John C. Virden Co.

Robert J. Sturwold and **E. B. Cook, Jr.,** have joined the organic research and process research sections, respectively, of the research staff of Emery Industries, Inc., Cincinnati, O.

Edward M. Laczynski has joined Michigan Chemical Corp., St. Louis, Mich., as researcher in the company's rare earths laboratories.

William F. Sullivan, Jr., staff superintendent of the tire division of The B. F. Goodrich Co., Akron, O., has been transferred to Industria Colombiana de Llantas, Bogota, Colombia, associate plant of International B. F. Goodrich Co.

Carroll P. Krupp has been appointed manager of product development in the aviation products division of The B. F. Goodrich Co., Akron, O. Formerly manager of new products development in B. F. Goodrich Industrial Products Co., he has been granted 36 patents since he joined Goodrich in 1936.

Willard S. Clepper has been named manager of warehousing and shipping for The B. F. Goodrich Co., Akron, O.

Peter J. Baier, Jr., has been named manager of transportation sales for the fiber glass division of Pittsburgh Plate Glass Co., Pittsburgh, Pa. He will be at the division's Chicago, Ill., office.

News Briefs

S. J. Pike & Co., Inc., New York, N. Y., has purchased all the capital stock of T. A. Desmond & Co., Inc., also of New York. The latter concern, which entered the rubber business in 1906, will continue, as heretofore, as importer, exporter, and trader in foreign and domestic commerce, specializing in the import of natural rubber, with headquarters at 40 Cortlandt St. S. J. Pike, Jr., was with Desmond for 22 years before he organized his own firm.

Dominion Rubber Co., Ltd., Montreal, P.Q., plans construction of a new warehouse at its Kitchener, Ont., Canada, plant.

Columbian Carbon Co. of Canada, Ltd., carbon black and pigment division, has moved its office in Toronto to 7 Superior Ave., Mimico, from its previous location on Edward St., according to Carl H. Croakman, vice president in charge of sales for the company.

Esso Research & Engineering Co., New York, N. Y., has granted a license to The Firestone Tire & Rubber Co., Akron, O., for producing butadiene under its patented extraction and purification process at a now-being-built plant near Orange, Tex. Nine other firms, three outside the United States, are also licensed under the process.

Pennsylvania Industrial Chemical Corp., Clairton, Pa., has opened a South Alantic district sales office in the Prudential Bldg., Room 1514, Jacksonville 7, Fla.

B. F. Goodrich Chemical Co., Cleveland, O., reveals that its Carbopol 934, a thickening and suspending agent, is being used in paint removers to prevent their dripping and to cut down evaporation rate.

Hercules Powder Co., Wilmington, Del., plans an extensive addition to production facilities at its oxychemicals plant in Gibbstown, N. J. This program involves doubling the production capacity of para-cresol and its derivatives. Hercules reports that it has under development a new antioxidant using para-cresol as one of the basic raw materials.

The General Tire & Rubber Co., Akron, O., a pioneer in the use of aircraft for company transportation, is, according to Fairchild Engine & Airplane Corp., Hagerstown, Md., the first corporation in the nation to place an order for the executive version of the Fairchild F-27, a twin-propjet, pressurized transport with a cruising speed in excess of 280 miles an hour.

Escambia Bay Chemical Corp. has changed its name to Escambia Chemical Corp., with executive offices at 261 Madison Ave., New York, N. Y. A new PVC plant, producing 30 million pounds of resin a year, will go into operation at the end of 1956 at the company's Pensacola, Fla., site.

W. J. Voit Rubber Corp., Los Angeles, Calif., says it has won its fight to gain recognition for the rubber-covered football under the rules of the National Collegiate Athletic Association. Teams on the offense will have a choice of rubber-covered or leather-covered footballs.

Goodrich-Gulf Chemicals, Inc., Cleveland, O., has awarded Girdler Co., Louisville, Ky., a contract for the construction of a $1,500,000 boiler house at its Institute, W. Va., synthetic rubber plant. The new power plant will generate 100,000 pounds of steam per hour in two boilers.

Phillips Chemical Co., rubber chemicals division, has relocated its western district sales office at 111 S. York St., Elmhurst, Ill. A. E. Laurence is office manager.

Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y., has moved its New York district sales office to 100 E. 42nd St., New York 17.

LaCrosse Rubber Mills Co., LaCrosse, Wis., recently was awarded a contract by the Philadelphia Quartermaster Depot for 39,632 pair of men's five-buckle, high black cleated rubber overshoes, with rubber outsole and heel, at a value of $164,869.12.

Eco Engineering Co., Newark, N. J., has introduced a self-priming pump for corrosives and hazardous liquids which features impellers made of Hycar American rubber, a product of B. F. Goodrich Chemical Co., Cleveland, O.

B. F. Goodrich Chemical Co. last month moved from the Rose Bldg., Cleveland, to 3135 Euclid Ave., Cleveland 15, O.

Pennsylvania Industrial Chemical Corp., Clairton, Pa., recently opened a new South Atlantic district sales office at Jacksonville, Fla. Harold L. Taylor has been appointed the district manager.

E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del., has adopted a stronger six-ply bag for packaging its Neoprene Type WRT which, unlike other neoprene types, flows under pressure.

Solvent Service, Inc., Painesville, O., specialist in chemical and hydraulic cleaning and descaling of industrial equipment, has acquired the accounts of Lemont Chemical Co., Lemont, Ill.

M. O. Rubber Co., Sun Valley, Calif., a recently formed partnership, of which J. Miller is a partner, will specialize in oil-field equipment and mechanical goods.

Los Angeles Chemical Co. has completed construction of a $300,000 plant on an 8½-acre site at 4565 Ardine St., South Gate, Calif. It will replace the present plant on S. Santa Fe Ave.

Obituaries

Thomas F. Callahan

Thomas F. Callahan, a rubber chemicals salesman in the Eastern Seaboard area for many years, died unexpectedly at his Akron, O., home on August 24 from complications arising from ulcers of the throat.

He was born in 1907 in Akron. He attended St. Vincent's High School there and worked in the physical testing laboratories of The B. F. Goodrich Co. for four years before entering Catholic University of America, Washington, D. C.

Upon graduation with a degree in chemical engineering in 1932, Mr. Callahan joined Palmer Carbon Co., Borger, Tex., and was employed in its laboratories until the company went out of business in 1937.

He then entered the sales field with Wishnick-Tumpeer Co., New York, N. Y., and moved on to its successor, Witco Chemical Co., where he remained until 1955. Since then he made his home in Akron.

During World War II, Mr. Callahan served for four years with the United States Navy and was discharged with a lieutenant's commission.

He was a member of the American Chemical Society and of the New York Rubber Group.

Mr. Callahan is survived by his wife, his parents, a sister, and a brother.

Requiem Mass was sung August 27 in St. Vincent's Church, Akron. Burial took place in Holy Cross Cemetery there.

Alva F. Myers

Alva F. Myers, since January, 1956, senior assistant treasurer of United States Rubber Co., New York, N. Y., died August 14 of a heart attack.

Mr. Myers was graduated from Pace College. In 1920 he joined U. S. Rubber as an accountant and was named an assistant treasurer in 1929.

The deceased was born in Brooklyn, N. Y., on July 15, 1894.

He was active in church and civic affairs in Rockville Centre, N. Y., where he had resided for 30 years. At the time of his death he had been living in Chappaqua, N. Y.

Surviving is his wife.

Ernest B. Caldwell

Ernest B. Caldwell, rubber technologist at the Mare Island Naval Shipyard rubber laboratory, Vallejo, Calif., died August 3 after an extended illness. He was 46.

Mr. Caldwell received his B. S. degree from Cornell College, Iowa, and began his career with The Goodyear Tire & Rubber Co., Los Angeles, Calif. He later was associated with E. M. Smith Co., Los Angeles, and Gates Rubber Co., Denver, Colo.

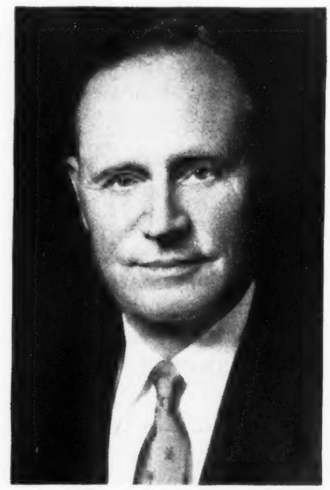
He was a member of several civic organizations and of the American Chemical Society.

He leaves his wife and a son.

Dent W. Sanford

Dent W. Sanford, vice president of Goodyear Tire & Rubber Co. of California, Los Angeles, Calif., died August 6 in Los Angeles following an extended illness.

He had been associated with Goodyear for 41 years, having joined the company in 1915 at El Paso, Tex. Mr. Sanford rose with Goodyear through successive sales positions to assistant sales manager of the tire sales department in Akron in 1932. Two years later he became manager of Goodyear's northeast division. In 1943 he was appointed head of the western division and was named vice president of Goodyear-California in 1944.



Dent W. Sanford

He was a past director of the Los Angeles Chamber of Commerce and the Merchants & Manufacturers Association and was a member of the California Club, Los Angeles Country Club, Stock Exchange Club of San Francisco, Los Angeles Press Club, and a director of the All Year Club.

The deceased was born in Springfield, Mo., on July 13, 1891.

Mr. Sanford leaves his wife, his mother, a daughter, a sister, and a grandchild.

Emil A. Krannich

Emil A. Krannich, who built rubber tires entirely by himself in 1912, died in Akron, O., on July 21. He was 75.

Mr. Krannich spent 35 years in the rubber industry with Goodrich, Goodyear, Mansfield, and many other companies no longer in existence. He retired in 1930, but returned to the Goodyear Aircraft Corp. in 1945, from which he retired again in 1950.

Services were held in Akron on July 24, with interment in Glendale Cemetery.

He is survived by his wife, a son, and five grandchildren.

Financial

American Brake Shoe Co., Detroit, Mich. First six months, 1956: net earnings, $4,825,770, equal to $3.92 a share, contrasted with $3,029,507, or $2.38 a share, a year earlier.

American Hard Rubber Co., New York, N. Y. Twenty-four weeks to June 7, 1956: net income, $586,659, equal to $1.69 a share, against $358,179, or 97¢ a share, in the corresponding period last year.

American Viscose Corp., New York, N. Y. First six months, 1956: net earnings, $8,807,000, equal to $1.73 a common share, compared with $12,135,000, or $2.27 a share, in the 1955 months; net sales, $121,971,000, against $129,228,000.

American Zinc, Lead & Smelting Co., Columbus, O. June half, 1956: consolidated net earnings, $1,534,231, equal to $1.30 a common share, against $1,077,285, or 91c a share, in the 1955 months; sales, $38-042,399, against $38,482,902.

Anaconda Wire & Cable Co., New York, N. Y. First six months, 1956: net income, $5,133,607, equal to $6.08 a capital share, contrasted with $3,083,612, or $3.65 a share, a year earlier.

Armstrong Cork Co., Lancaster, Pa. June half, 1956: net income, $6,847,783, equal to $1.32 a common share, compared with $7,024,720, or $1.37 a share, in last year's half; net sales, $123,289,041, against $123,568,706.

Belden Mfg. Co., Chicago, Ill. Six months ended June 30, 1956: net income, $861,035, equal to $2.22 a share, compared with $647,427, or $1.68 a share, in the same period last year.

Borden Co., Peabody, Mass. Half ended June 30, 1956: net profit, $10,710,000, equal to $2.72 a share, against $10,060,-000, or $2.14 a share, a year earlier.

Borg-Warner Corp., Chicago, Ill., and subsidiaries. First half, 1956: net income, $14,451,362, equal to $1.81 a common share, compared with $18,792,897, or $2.38 a share, in the 1955 half; net sales, $248,-306,838, against $283,916,530.

Carborundum Co., Niagara Falls, N. Y., and United States and Canadian subsidiaries. First half, 1956: net income, $3,537,758, equal to $2.06 a capital share, compared with $2,715,950, or $1.58 a share, a year earlier: sales, $51,283,103, against $44,849,106.

Brown Rubber Co., Inc., Lafayette, Ind. Half ended June 30, 1956: net earnings, $132,672, contrasted with $426,891 for the first half of 1955.

Brunswick-Balke-Collender Co., Chicago, Ill. Six months ended June 30, 1956: net profit, $391,000, contrasted with net loss of $288,870 in the 1955 months.

Canada Wire & Cable Co., Ltd., Leaside, Toronto, Ont. June half, 1956: net profit, $1,245,000, against $931,000 in the 1955 half.

Philip Carey Mfg. Co., Plymouth Meeting, Pa. Six months to June 30, 1956: net income, $914,343, equal to $1.08 a share, compared with $1,128,792, or $1.28 a share, in the first six months of 1955.

Celanese Corp. of America, Charlotte, N. C. First six months, 1956: net income, $6,185,602, equal to 65¢ a common share, against $7,221,797, or 83¢ a share, a year earlier; net sales, $94,421,267, against $93,248,262.

Columbian Carbon Co., New York, N. Y. June half, 1956: net profit, $3,237,-247, equal to $2.01 a share, against $3,-147,619, or $1.95 a share, in the 1955 half.

Cooper Tire & Rubber Co., Findlay, O. June half, 1956: net income, $301,287, equal to $1.92 a share, compared with $180,628, or $1.15 a share, a year earlier.

Cosden Petroleum Corp., Big Spring, Tex. Year ended July 31, 1956: net profit, $5,408,597, equal to $2.46 a share, compared with $3,907,494, or $1.78 a share, in the preceding fiscal year.

Crown Cork & Seal, Inc., Baltimore, Md. Initial half, 1956: net income, $891,-316, equal to 51¢ a share, against $855,-790, or 48¢ a share, a year earlier.

Crown Cork International, Baltimore, Md. June half, 1956: net earnings, $596,-489, equal to $1.54 a share, against $513,-564, or $1.32 a share, in the like period last year.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. January 1-June 30, 1956: consolidated net profit, $187,824,657, equal to $4.01 a share, against $186,392,722, or $3.98 a share, in the first six months of 1955; sales, 943,734,687, against $958,-145,656.

DeVilbiss Co., Toledo, O. Six months to June 30, 1956: net earnings, $773,848, equal to $2.15 a share, contrasted with $507,807, or $1.35 a share, in the corresponding months of the previous year.

Dow Chemical Co., Midland, Mich., and subsidiaries. Year ended May 31, 1956: net earnings, $59,656,040, equal to $2.52 a common share, compared with $37,414,-257, or $1.64 a share, a year earlier; net sales, $565,260,085, against $470,741,829; income taxes, $54,600,000, against $35,-900,000.

Endicott Johnson Corp., Endicott, N. Y. Initial half, 1956: net income, $1,497,-003, equal to $1.67 a share, against $1,-551,995, or $1.74 a share, in last year's half.

Flintkote Co., New York, N. Y., and domestic subsidiaries. Twenty-eight weeks ended July 14, 1956: net profit, $2,273,797, equal to $1.53 a common share, against $2,390,778, or $1.62 a share, in the 1955 weeks; net sales, $53,329,827, against $52,932,217.

General Cable Corp., New York, N. Y. January 1-June 30, 1956: net earnings, $5,491,047, equal to $1.93 a share, compared with $2,950,114, or $1.27 a share, in the like period last year.

General Electric Co., Schenectady, N. Y. First six months, 1956: net income, $112,864,000, equal to $1.30 a share, against $107,799,000, or $1.24 a share, a year earlier.

General Motors Corp., Detroit, Mich. First half, 1956: net income, $503,471,823, equal to $1.80 a share, compared with $660,961,942, or $2.41 a share, in the 1955 half.

The General Tire & Rubber Co., Akron, O., and consolidated subsidiaries. Six months ended May 31, 1956: net income, $4,027,431, against $4,027,153 a year earlier; net sales, $177,796,438, against $135,342,661.

The B. F. Goodrich Co., Akron, O. Six months ended June 30, 1956: net earnings, $21,507,367, equal to $2.41 a share, against $22,291,357, or $2.52 a share, a year earlier; net sales, $364,374,921, against $372,355,401.

Goodyear Tire & Rubber Co., Akron, O., and subsidiaries. First half, 1956: net profit, $30,655,683, equal to $3.02 a common share, compared with $27,268,497, or $2.68 a share, in the 1955 half; net sales, $683,066,058, against $679,672,925.

Industrial Rayon Corp., Cleveland, O. June half, 1956: net income, $3,476,551, equal to $1.88 a share, contrasted with $5,585,846, or $3.02 a share, in the like period last year; net sales, $31,891,030, against $43,689,293.

Hewitt-Robbins, Inc., Stamford, Conn. June half, 1956: net income, $513,313, equal to $1.50 a common share, against $485,271, or $1.57 a share, a year earlier; net sales, $25,616,250, against $21,479.077.

Johns-Manville Corp., New York, N. Y., and subsidiaries. Six months ended June 30, 1956: net profit, $12,004,685, equal to $1.87 a common share, compared with $9,262,441, or $1.45 a share, in last year's period; sales, $147,359,000 against $131,-720,469.

Johnson & Johnson, New Brunswick, N. J. Six months ended June 30, 1956: net profit, $6,526,000, equal to $3.10 a share, against $5,888,000, or $2.79 a share, a year earlier.

Koppers Co., Inc., Pittsburgh, Pa. Six months ended June 30, 1956: net profit, $6,930,522, equal to $2.89 a share, compared to $4,871,851, or $2.29 a share, in the '55 months.

Liquid Carbonic Co., Chicago, Ill. Nine months ended June 30, 1956: net profit, $1,939,308, equal to $1.71 a common share, against $1,643,826, or $1.54 a share, in the like period last year; net sales, $24,-496,287, against $33,355,798.

Mansfield Tire & Rubber Co., Mansfield, O. First six months, 1956: net profit, $701,-450, equal to $1.14 a common share, compared with $993,668, or $1.74 a share, in the 1955 half; net sales, $31,593,710, against $38,468,754.

McNeil Machine & Engineering Co., Akron, O. First half, 1956: net profit, $1,362,273, equal to $2.32 a common share, against $1,233,745, or $2.14 a share, a year earlier.

Minnesota Mining & Mfg. Co., St. Paul, Minn., and domestic and Canadian subsidiaries. Six months to June 30, 1956: net profit, $17,814,767, equal to $1.06 a common share, compared with $15,781,-268, or 96¢ a share, in the 1955 months; net sales, $154,495,586, against $131,-645,501.

Monsanto Chemical Co., St. Louis, Mo., and consolidated subsidiaries. Six months ended June 30, 1956: net income, $21,974,-586, equal to $1.05 a share, compared with $24,543,419, or $1.16 a share, in the corresponding months of 1955; sales, $280,256,773, against $266,203,707.

Mt. Vernon Mills, New York, N. Y. First six months, 1956: net income, $757,-000, equal to $1.15 a share, compared with $556,000, or 86¢ a share, in the 1955 months.

National Automotive Fibres, Inc., Trenton, N. J. Six months ended June 30, 1956: net loss, $48,860, contrasted with net profit of $1,888,852 in the 1955 period.

National Lead Co., New York. N. Y. Six months ended June 30, 1956; net income, $28,998,985, equal to $2.45 a common share, compared with $23,503,085, or $1.97 a share, in the 1955 half; sales, $289,234,320, against $256,790,904.

National Rubber Machinery Co., Akron. O. Initial half, 1956: net profit, $289,728, equal to $1.48 a capital share, compared with $314,913, or $1.61 a share, in the 1955 period; sales, $6,100,046, against $5,882,481.

New Jersey Zinc Co., New York, N. Y., and subsidiaries. Initial half, 1956: net earnings, $1,018,403, equal to 52¢ a share, contrasted with $2,563,691, or $1.31 a share, in the 1955 half; sales, $9,320,739, against $10,066,382.

Nopco Chemical Co., Harrison, N. J., and subsidiaries. June half, 1956: net earnings, $804,550, equal to $1.60 a common share, against $702,219, or $1.41 a share, in the like period last year; sales, $13,-378,798, against $11,418,213.

Okonite Co., Passaic, N. J. First six months, 1956: net profit, 982,747, equal to $5.09 a share, contrasted with $672,331, or $3.72 a share, in the 1955 period.

O'Sullivan Rubber Corp., Winchester, Va. Six months to June 30, 1956: net loss, $46,400, contrasted with net profit of $42,-164 a year earlier.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Six months to June 30, 1956: consolidated net income, $2,147,972, equal to $1.73 a capital share, compared with $1,-975,766, or $1.59 a share, in the corresponding half of 1955; sales, $37,118,293, against $33,906,592.

Phelps Dodge Corp., New York, N. Y. Six months to June 30, 1956: net income, $51,124,617, equal to $5.04 a share, contrasted with $32,672,177, or $3.22 a share, in the corresponding months last year.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. June half, 1956: net profit, $51,565,719 equal to $1.50 a share, compared with $42,575,770, or $1.40 a share, in the same period last year.

Plymouth Rubber Co., Canton, Mass. First six months, 1956: net earnings, $471,-515, equal to 53¢ a share, against $312,422, or 35¢ a share, a year earlier.

H. K. Porter Co., Inc., Pittsburgh, Pa. Initial half, 1956: net income, $3,991,746, equal to $3.72 a share, contrasted with $1,994,325, or $1.92 a share, in last year's half.

Raybestos-Manhattan, Inc., Passaic, N. J. First half, 1956: net earnings, $1,983,449, equal to $3.16 a share, against $1,988,473, or $3.16 a share, a year earlier.

Pittsburgh Plate Glass Co., Pittsburgh, Pa., and consolidated subsidiaries. First half, 1956: net profit, $30,258,088, equal to $3.08 a share, compared with $32,562,-512, or $3.31 a share, a year earlier; sales, $292,518,948, against $288,536,825.

Rome Cable Corp., Rome, N. Y. Quarter ended June 30, 1956: net earnings, $540,000, equal to $1.02 a capital share, against $380,000, or 74¢ a share, in the 1955 period.

St. Joseph Lead Co., New York, N. Y., and subsidiaries. Initial half. 1956: net earnings, $5,076,591, equal to $1.86 a capital share, contrasted with $6,741,906, or $2.48 a share, in the 1955 half; net sales, $59,183,520, against $62,427,726.

Seiberling Rubber Co., Akron, O. First six months, 1956: net income, $452,820, equal to 85¢ a common share, against $450,407, or 84¢ a share, in the same months last year; net sales, $24,018,569, against $21,491,511.

Shell Oil Co., New York, N. Y., and wholly owned subsidiaries. Half ended June 30, 1956: net profit, $69,440, 912, equal to $2.52 a capital share, compared with $54,497,284, or $1.98 a share, in the same months last year; sales, $791,573,920, against $713,465,632.

Sun Oil Co., Philadelphia, Pa., and subsidiaries. Six months ended June 30, 1956: net earnings, $25,138,552, equal to $2.48 a common share, against $24,407,336, or $2.53 a share, in last year's half.

Union Carbide & Carbon Corp., New York, N. Y. First six months, 1956: net profit, $70,099,178, equal to $2.40 a common share, compared with $63,614,898, or $2.20 a share, a year earlier; net sales, $617,887,728, against $554,267.447.

United Engineering & Foundry Co., Pittsburgh, Pa., and subsidiaries. Initial half, 1956: net earnings, $1,980,051, equal to 79¢ a common share, compared with $1,183,589, or 47¢ a share, in the '55 half; net sales, $28,970,023, against $23,270,-386.

United States Rubber Co., New York, N. Y. Initial half, 1956: net earnings, $18,659,106, equal to $2.97 a common share, against $19,005,463, or $3.03 a share, in the first half of 1955, net sales, $464,095,454, against $457,039,061.

Westinghouse Electric Corp., Pittsburgh, Pa. Six months to June 30, 1956: net loss, $11,713,000, contrasted with net profit of $29,417,000 in the 1955 months: net sales, $606,097,000, against $755,963,000.

Westinghouse Air Brake Co., Wilmerding, Pa. Six months to June 30, 1956; net profit, $6,135,849, equal to $1.47 a share, contrasted with $3,227,911, or 78¢ a share, in the same months of 1955.

(Continued on page 934)

News from Abroad

Malaya

Sales of Rubber Estates

The sale of British-owned rubber estates to Indian, but more especially to Chinese, purchasers, is continuing, but there are now many more offers than takers, the latest news from Malaya indicates. In the Province Wellesley, only a few British-owned estates are now left. At the beginning of August the local press reported that seven estates of the Penang Rubber Estates, covering 13,000 acres, were sold recently, four of them to a Chinese syndicate and three to an Indian group. It is understood that the estates, some of which have been under British management for more than half a century, may, at least in part, be broken up and resold as small holdings. In addition, two other British-owned estates in this area were sold to Malayan firms. In Selangor, six British-owned rubber estates passed into Asian hands.

Since 1951, there have been many such sales, but according to local sources, the trend is tapering off. Chinese are less eager than formerly to buy up European estates. It is believed that this attitude may to some extent be due to the fact that a good deal of Chinese capital has been tied up in Japanese estates sold about two years ago. A local business man is quoted as saying that the situation was simply one where more people were out to sell at a good price than there were people with money enough to buy. Then, too, prospective buyers shy away from estates in bandit-ridden areas; finally, the falling rubber price has had its effect also.

Opinions differ as to the reason why so many British rubber companies are attempting to get rid of their Malayan holdings; it has been pointed out that they are to a large extent small enterprises, and an uncertain financial position might very well induce owners to try to unload while they could; for some, the reason might be that their estates are in dangerous areas. On the other hand, fearfulness of the policy toward foreign investors that Malaya may adopt once it gains its independence next year has frequently been suggested as the motive for selling.

Rubber Exports Decline

American purchases of natural rubber from Malaya in the first half of 1956 were the lowest in nine years, figures just released reveal. At 74,767 tons, they were 27% less than the 1955 amount of 102,408 tons and 35% below the British share in the 1956 period. The United Kingdom, with 115,709 tons, against 97,710 tons in the first half of 1955, thus became Malaya's best customer; while the United States dropped to second place. France and Germany also exchanged places, although in this case both countries had reduced their 1956 off-take. Malaya exported 472,063 tons of rubber in the 1956 period, against 492,747 tons in the corresponding period of 1955; imports at the same time were 163,235, against about 172,800 tons. In the table below are given the shipments (in tons) to Malaya's chief customers, as they ranked in 1956:

	First Half	
	1956	1955
United Kingdom	115,709	97,710
United States	74,767	102,408
West Germany	40,462	42,042
France	35,911	49,845
Japan	34,668	35,715
Italy	25,386	27,406
Australia	16,965	21,643
Netherlands	14,363	8,312
Canada	14,135	18,206
U. of S. Africa	12,124	13,802
Argentina	7,581	15,017

It will be noted that except for the United Kingdom and Netherlands, all countries took less rubber from Malaya in 1956. Conspicuous in the table are the sharp rise in shipments to the Netherlands —up roughly 75%—the almost 50% drop in those to Argentina, and the reduction by about 14,000 tons in the business with France.

Exports of latex in the first half of 1956 at 48,470 tons were 14,900 tons below the record figure for 1955, but still were 16.7% higher than in the first half of 1954 and 43% more than in the same period of 1953. The drop was largely due to smaller purchases by the United States (15,559, instead of 24,871 tons); the United Kingdom also took less latex—14,684, against 17,465 tons. But there were relatively substantial increases in shipments to France, 3,122, against 2,497 tons; Germany, 4,361, against 3,268 tons; and Japan, 2,137, against 1,369 tons.

Uneasy Labor Peace

The agreement between the MPIEA and the National Union of Plantation Workers, granting increased wages and more holidays, has brought little peace so far, it seems. There are complaints that some estate managers, in trying to evade the provisions of the agreement instead of paying field workers the amount agreed on for an eight-hour day, are giving their people six or seven hours of work and reducing wages proportionately. Others, it is claimed, insist that the wage rates were fixed on the understanding that a definite number of trees be tapped by each tapper and have taken steps to insure that there are enough trees in each tapper's task, with the result that on several estates tappers have refused their wages because they felt they were not being paid enough for the work they were doing. At the same time, the efficiency and economy measures by management have led to reduction in the labor force, which has further disturbed labor and aroused the concern of the union.

Apparently we are witnessing the result of attempts by managers to keep production costs down while wages mount and prices are at what is now considered an uneconomic level. In this connection, we note that the uneconomic price level was the reason given recently by an estate in Perak for closing down. It is suggested that more estates may follow suit if prices do not improve. It has freely been predicted that if production costs—which means mainly cost of labor—continue to be out of line with rubber prices, increasing unemployment will necessarily follow; replanting, which reduces the need of tappers and factory workers on the estate, is not expected to ease matters in this respect.

Meanwhile dissatisfaction among workers is again trying to find an outlet in the strike. About the middle of August, more than 10,000 rubber plantation workers in Selangor, employed on estates under the same management, threatened a one-day strike in protest against the dismissal of 49 men considered by the directors to be trouble makers. The union was understood to be considering the extension of the strike to all estates of the group throughout the country if the matter was not settled.

New RRI Tapping Method May Mean Increased Yields

Enthusiastic accounts have appeared in the local press about a new tapping system that has been developed at the Rubber Research Institute, by which trees can be made to yield two or three times their present crop.

From the *Planters' Bulletin*, of the Rubber Research Institute, for July, it becomes clear that we have here a new approach to the double-cut system, which is based on the assumption that local wounding (tapping) produces only a local reaction of the bark (latex flow), and that if the areas of bark drained do not overlap, the tapping of the two cuts can be considered as two separate tapping procedures.

Hence if good mature trees are able to stand their customary one-cut tapping regimen, they might undergo a system with two, well-separated cuts, one high up on the tree, and one at the usual height. Proper distances between the cuts are necessary to prevent overlapping and possible, consequent high incidence of brown bast disease; as an added precaution, the cuts are made on opposite sides of a tree.

The new system was tested on a group of 26-year-old buddings whose yield had dropped when they were tapped on second renewal bark. Both cuts were made on

the same day. Over a period of 18 months the trees more than doubled their yield; the high cut contributed most of the increase. Later the method was applied to old seedlings and during the six months that this trial has lasted gave similar results. The addition of yield stimulant applied alternately to high and low cuts at intervals of three months in this test gave an increase in crop of 261%.

How long the trees can stand this treatment has, admittedly, yet to be discovered. But experience with the much more severe slaughter tapping methods suggests that the proposed, relatively mild system could be continued for two or three years, during which trees would be giving about twice as much latex as with the usual methods. Until it is known what the long-term results may be, no recommendations are made, but estates are being advised to undertake small-scale tests only on older trees for the present.

Graft Polymer Production

The July issue of *Planters' Bulletin* contained some notes on recent work in Malaya on graft polymers. The task of the Rubber Research Institute of Malaya was to determine whether the methods developed in England require modification before they could be applied to freshly prepared latex in Malaya and to compare costs of production in the two countries. For rubber methyl methacrylate graft and rubber styrene graft, simple methods of preparation were developed which could be used in most Malayan estate factories and yielded products similar to those made in England. In regard to the former graft, the problem of preparing a coherent coagulum instead of discrete flocculent particles was solved by careful control mainly of pH, dilution, and ions condition, and a coagulum was obtained which could be sheeted on a creping mill without too much trouble. Batches of 150 pounds of grafts containing 30 and 50% methacrylate have been successfully prepared. Optimum proportions of free rubber, free polymer, and true graft rubber are being sought.

Preparation of rubber styrene graft in Malaya seems to offer advantages; the reaction takes place readily at the tropical temperatures; whereas in England the latex must be heated. Contrary to English experience, coagulation is straightforward.

Self-Sterilizing Paint

Also appearing in the July issue of *Planters' Bulletin* is an item on the use of self-sterilizing paint to inhibit the development of harmful "factory bacteria" in commercial latex, that is, bacteria which have become resistant to the concentration in fully ammoniated latex as a result of continuous contact with high concentrations of ammonia in the factory. A self-sterilizing paint provides a porous surface from which a potent bactericide slowly diffuses. A useful paint of this type, which has remained effective for several months after many washings, has been developed in England, and tests at the Rubber Institute have shown its value for general use in rubber estate factories here. Further tests are necessary before a paint can be recommended for use in direct and permanent contacts with fully ammoniated latex concentrate, for the interior of drums, rail tankers, and ships' tanks.

Italy

Factory Layoffs Necessary

The Pirelli Rubber company of Milan, Italy's foremost rubber manufacturing company and one of the largest industrial undertakings in the country, has called for "voluntary resignations" by workers at a group of its factories at Bicocca, near Turin. The firm, which produces a wide range of rubber goods besides tires, wishes to reduce the "super-abundance of labor which is taking on alarming proportions," and which includes chiefly labor working on short time, without having to resort to mass firings. Pirelli has offered those who leave a 50% increase in the usual compensation for dismissal, plus payment for 500 to 1,000 working hours; family men would get additional payment of 20,000 to 200,000 lire.

According to trade sources, the measure is one of the results of the crisis through which the Italian rubber industry is passing. Tire sales have dropped more than 50%, with large-size truck tires particularly badly hit. The fall in sales has been ascribed to bad weather, competition by the Italian State Railways which has cut motor transportation, and the government's price-fixing policy.

In recent weeks other big Italian rubber companies have also been dismissing workers: Michelin, of Turin, let 150 persons go, and Cast, also of Turin, 115. Pirelli, which employs about 14,000 persons, would like to drop at least 1,000.

Great Britain

Growers' Report Outlines Industry's Girding Defenses

The exemption from duty of raw butyl rubber imported into the United Kingdom was rescinded by the Government's Board of Trade as a result of a vigorous protest by The Rubber Growers' Association. Plans to lift the duty on imported GR-S type synthetic rubber were also cancelled then.

The success of this protest by a section of the natural rubber industry was revealed in the year-end statement of the council of the Rubber Growers' Association to its members concerning activities in 1955.

In June, 1955, raw butyl rubber had been exempted from the general import duty of 10% until the end of 1955. Following the RGA's protest, the duty was reimposed beginning January, 1956, and an application for the exemption from duty of SBR was rejected.

Less successful, however, was the RGA's attempt to convince the government that the natural rubber industry was being subjected to discriminatory over-taxation and that the government's proposals on replanting would aggravate rather than relieve the industry's financial problems.

The report also outlined the RGA's interest in a stepped-up program of research and development. It was suggested to the Rubber Producers' Council that a committee of investigation be set up to review all aspects of research and development, and that control of research in the United Kingdom be transferred from the Colonial Office to the industry.

It was later announced in Kuala Lumpur that the Rubber Producers' Council had set up a committee of investigation, headed by Prof. G. E. Blackman, to examine problems of research and development affecting the rubber industry.

J. W. A. Calver, RGA chairman, addressed the general meeting of the group in London, April 27, at which the annual report was presented. He urged rubber growers to seek economies of production that would put natural rubber on a direct competitive level with synthetic rubber and plastics substitutes.

"If we ourselves were to produce enough of the rubber, which is a free gift of nature, really cheaply, it would be unnecessary for the world to go to the trouble of making substitutes for it from raw materials which are in any case useful for other purposes," he said.

Netherlands

Houwink to Atomic Energy

R. Houwink, internationally known as the director general of Rubber Stichting, Delft, resigned May 31 to become technical director of the Nuclear Reactor Center, Netherlands, an organization established to develop industrial applications of atomic energy for the Netherlands.

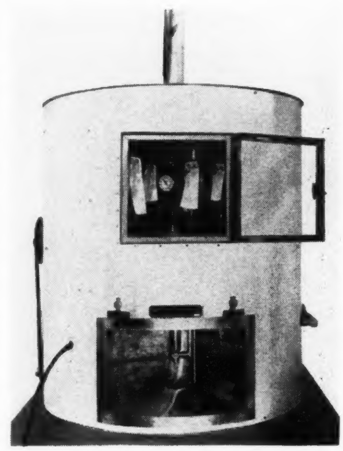
Born October 26, 1897, at Meppel, Holland, Dr. Houwink, after completing his studies at Delft in 1921, became chemical engineer at the Rijks Rubber Dienst (National Rubber Bureau), Delft, under Prof. A. van Rossem; in 1923, Houwink joined Vredestein Rubber Co., Loosduinen, and in 1925, N. V. Philips Gloeilampen Fabrieken, again as chemical engineer. He remained with the latter concern 14 years and built up its newly established phenolic plastics section. He left in 1939 to become director general of Rubber Stichting.

In the meantime he had taken his doctorate in 1937, with honors; his thesis was "Physikalische Eigenschaften und Feinbau von Natur u. Kunstharzen" ("Physical Properties and Micro Structure of Natural and Synthetic Resins) and had also published a second book, "Elasticity, Plasticity, and Structure of Matter." At Delft he had full opportunity of displaying his talents as scientist and administrator, as well as his driving energy. He saw the Stichting adequately housed and during the war saved it by suggesting to the Nazi

(Continued on page 932)

NEW EQUIPMENT

Fume Test Chamber



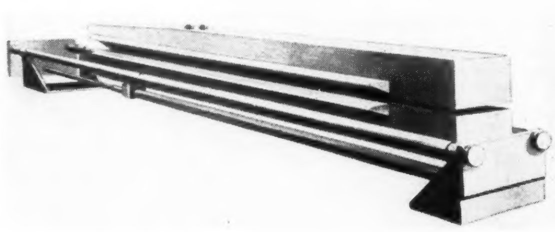
Gas Fading Chamber, drum type

A device to evaluate atmospheric gas reactions on such fume-vulnerable materials as rubber, plastics, and textiles has been placed on the market by United States Testing Co., Inc., Hoboken, N. J. Called Gas Fading Chamber, it consists of a corrosion-resistant chamber, self-sealing closure, and exhaust vent.

By introducing special valve ports into the main supply line, different gases can be mixed and fed in controllable quantities into the chamber, according to the company. Samples in the chamber are automatically rotated for uniform exposure. Interior lighting permits observations to be recorded during the progress of the test, and a dial thermometer enables testing to be accomplished at a known temperature.

The Gas Fading Chamber can test resistance of materials to gases, the efficacy of inhibitor substances, and the susceptibility to gas absorption of specific materials.

The device is available in two models: the drum type, which conforms to specifications of the American Society for Testing Materials (D682-52), the American Standards Association (L-14 and L-22), and the American Association of Textile Chemists & Colorists; and the squirrel-cage model, a more compact type, which meets the requirements of the ASA and the AATCC.

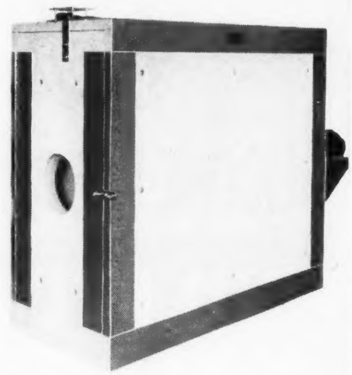


Source and radiation chamber of an Atom-At gage

Beta-Radiation, Thickness-Measuring Gages

A new series of beta-radiation, non-contact thickness-measuring gages for the continuous measurement and production control of rubber, plastics, coatings, laminates, and other materials has been introduced by Nuclear Corp. of America, Inc., New York, N. Y. Called Atom-At, the gages are available in five basic types: the transmission gage for rubber, plastics, and other sheet materials; the backscatter gage for measuring coatings such as rubber, adhesives, paint, lacquer, and other moving materials which are accessible from only one side; the differential gage for measuring coatings on thin materials; the multiple-head transmission gage for greater widths of the same materials; and the transverse profile portable gage which measures thickness across the entire width of a sheet.

Oven Furnaces for Materials Testing

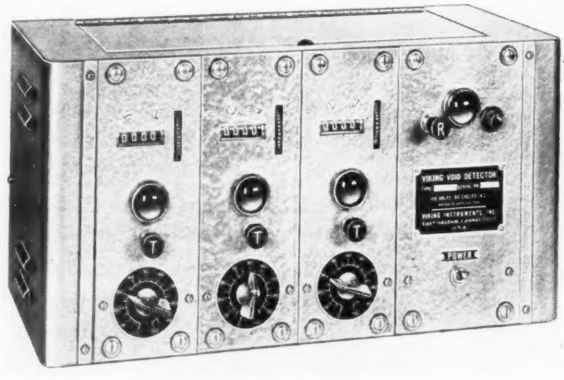


Marshall Products' oven furnace

A new line of oven furnaces, designed for use in tensile, compression, and bending tests, has been placed on the market by Marshall Products Co., Columbus, O. Specific applications of the oven furnaces, according to the company, include high-temperature testing of adhesive bonds, cemented, fabricated, or laminated assemblies, rubber or plastic units, and aluminum or alloy products.

The oven furnaces are equipped with a fan at the closed end of the oven to provide air circulation and temperature uniformity. Viewing windows, hand holes, and other access ports are furnished to meet individual requirements. Customer requirements will determine the size of the oven furnaces, since they will be designed to fit between the columns of such testing machines as the Baldwin, Reihle, and Olsen, according to Marshall Products.

Said to be well insulated and sturdily constructed, although light in weight for convenience of handling, the oven furnaces are available in two different types: one with a temperature range of 100-900° F.; the other with a range of up to 1350° F.



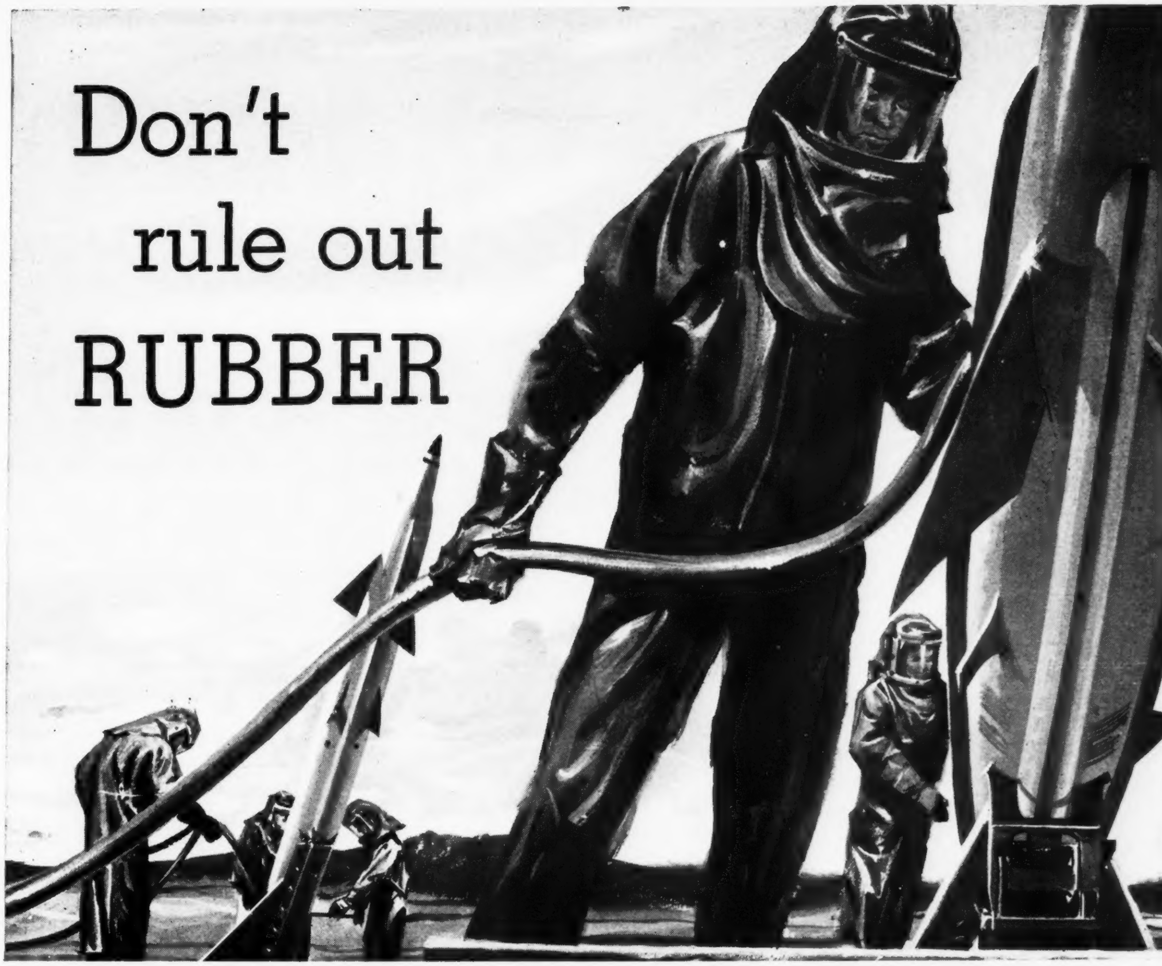
Viking Void Detector

Hole Detector for Rubber, Plastic Sheets

An instrument for detecting small or large holes in such electrically non-conducting materials as rubber, plastics, and paper has been introduced by Viking Instruments, Inc., East Haddam, Conn. Called Viking Void Detector, it includes the use of a one-, two-, or three-position indicator unit connected electrically to feeler brushes. The standard model of the Void Detector, designed for impressed voltage of 110-volt, 60-cycle AC, tests materials up to 0.025-inch thick and records holes of 1/64-inch diameter and larger.

According to the company, the feeler brushes are attached to the roll, plate, or bar which is processing the dielectric material. When a void in the material passes between the feeler brush and the grounded roll, plate, or bar, a low-voltage pulse is transmitted to the indicator unit where it is measured and recorded. A sensitivity adjustment permits the differentiation between hole sizes to be detected.

Audible alarms may be connected to the instrument, as well as 24-hour recording equipment. The two- and three-position instruments record and count the holes in the material and indicate the sections in which they appear.



Transfer Hose of KEL-F Elastomer handles red fuming nitric acid over long periods of time without deteriorating. **Protective Clothing** of elastomer-coated fabric shields workers from corrosive materials.

KEL-F® Fluorocarbon Elastomers are doing jobs that rubber never did before!

Rubber is perhaps the most useful and versatile non-metallic material used by industry today. Its resilience and resistance to abrasion and breakdown make it an important tool in industrial techniques and plant equipment.

Yet in many applications—where the mechanical properties of rubber are vitally needed—extremely high-temperature and corrosive operating conditions rule out its use.

The development of KEL-F Fluorocarbon Elastomer fills a long felt need. Here is a high strength rubber that can operate effectively under conditions that swell, stretch and melt ordinary rubber.

Today, KEL-F Elastomer can be considered for those jobs once thought "impossible" for rubber. Just check its outstanding properties:

- Extreme resistance to acids, ozone, and other oxidants
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KEL-F Elastomers have convincingly demonstrated their value in a variety of industrial roles: As *sealants* for corrosive liquids, abrasion and corrosion resistant *pump impellers* . . . heat and chemical resistant *hose, tubing, diaphragms, gaskets . . . transmission, brake* and *aircraft seals* . . . corrosion and flame resistant *protective clothing* . . . electrical and shock *insulation*.

This new elastomer is a result of Kellogg's comprehensive research in fluorocarbon chemistry. Its performance characteristics are well established in the chemical, electrical and equipment fields. If your work involves rubber at any point, then KEL-F Elastomer warrants investigation.

Our Technical Staff is prepared to work with you in adapting KEL-F Elastomer to your needs. For further information, write: The M. W. Kellogg Company, Chemical Manufacturing Division, P. O. Box 469, Jersey City 3, N. J.

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NEW MATERIALS

Neville Flaked Antioxidant—Nevastain B

A solid, flaked form of non-staining, non-discoloring antioxidant for convenience of weighing and handling in rubber compounding operations is being made available by Neville Chemical Co., Pittsburgh, Pa. Designated Nevastain B, it is compatible with synthetic and natural rubbers, does not bloom at more than double normal dosage, does not interfere with the rate of cure, and is soluble in the usual rubber solvents, according to the company. This antioxidant has a specific gravity @ 25/25° C. of 1.137 and a minimum melting point of 55° C. by the capillary method.

Technical Service Report No. 49, giving recommended compounding procedures, a comparison of the performance of Nevastain B with another antioxidant in a natural rubber recipe, and suggestions for making dispersions of Nevastain B, is available from the company on request.

Tygobond Adhesive for Foams

Three resinous base adhesives for bonding vinyl and polyurethane foam to themselves or to vinyl fabrics, metal, wood, or composition bases have been added to the line of U. S. Stoneware Co., adhesives division, Akron, O. Designated Tygobond 40, 41, and 45, they are pressure-type adhesives that dry in air to a clear, non-staining bond resistant to water, acids, alkalies, oils, and some solvents.

Tygobond 40 is formulated for spray application; Tygobond 41 and 45, for brush or machine-coating application. Tygobond 40 and 41 are recommended for joining vinyl or polyurethane sponge and foams to semi-rigid or rigid bases. Tygobond 45 is said to give a very resilient bond and is suggested for use in foam upholstery construction when pieces of the foam must be joined so that the bond line will not telegraph through the overlay material.

The adhesives are also practicable for bonding thermoplastic sheet and film, leather, paper, felt, or textiles to ceramic, wood, metal, or composition bases, according to the company.

Acrylic Thickener—Acrysol ASE-75

A new type of high-solids acrylic thickener and dispersant for aqueous systems has been developed by Rohm & Haas Co., Philadelphia, Pa., Called Acrysol ASE-75, it is supplied as a water-thin dispersion of 40% solids and low pH which converts instantly to a clear, viscous solution upon dilution and the addition of a base. The viscous solution may then be used as a thickener, binder, and suspending agent. A substantial reduction in shipping costs is effected, the company says.

According to Rohm & Haas, Acrysol ASE-75, as the sodium, potassium, or ammonium salt, is a highly efficient thickening agent for latex emulsion paints, natural and synthetic latex compounds, adhesives, and other aqueous suspensions. The polymer resists putrefaction and provides viscosity stability on aging over long periods of time. Use of the thickener is also anticipated in other applications where dry powders or low-solids thickeners are now being employed.

Some typical physical properties of Acrysol ASE-75 have been reported as follows:

pH	3.0, approx.
Viscosity, Brookfield, @ 25° C.	20 cps.
Specific gravity, @ 25° C.	1.08
Solids	40%
Appearance	milky liquid
Colloidal charge	anionic

Hycar Carboxylic-Modified Nitrile Rubber

A medium-high acrylonitrile-butadiene polymer which has been modified to include carboxylic groups in the polymer chain has been developed by B. F. Goodrich Chemical Co., Cleveland, O. Designated Hycar 1072X3, it is basically similar to the company's Hycar 1042 except for the carboxylic modification. The modification of the molecule is said to have a considerable effect on the polymer properties; changes are most apparent in the reaction of Hycar 1072X3 with curatives, the physical properties of the vulcanizates, and the compatibility of the rubber with plastic materials.

According to Goodrich, stocks made with this modified nitrile rubber have remarkable resistance to shock at low temperatures despite a hardness value that commonly exceeds 65 Shore A. On high-temperature aging in a swelling-type oil, the hardness is usually decreased less than typically occurs with polymers of comparable acrylonitrile content.

These advantages, in addition to high abrasion resistance, excellent initial stress and strain characteristics, and good retention of properties at elevated temperatures make the polymer suitable to a wide variety of applications, the company says. These include gaskets, O-rings, pump parts, shoe soles, adhesives, oil-resistant molded goods, floor tile, mats, binders for brake linings, weather stripping, protective clothing, belting, solid tires, and packings.

Goodrich reports that the difference in the physical properties of Hycar 1072X3 and Hycar 1042 is developed only in formulations that contain zinc oxide or other metallic salts among the curing ingredients. A recipe containing curatives, but no zinc oxide, will produce little variation in properties between these two polymers. However, Hycar 1072X3 cured with zinc oxide, sulfur, and accelerator develops all the advantages outlined above.

Service Bulletin H-21, describing Hycar 1072X3 and also its compounding with Geon PVC resins, phenolic resins, as methyl ethyl ketone cements, and in shoe sole compounds, is available from the company.

Antistat "A" for PVC Films

A compounding ingredient for flexible vinyl films that frees the product from static electric charges is being distributed by Baird Chemical Corp., New York, N. Y. Dubbed Antistat "A", it is said to be a compatible, conductive light amber liquid which is easily incorporated into the resin without noticeable effects on the properties of the vinyl. Antistat "A" is free from amine groups and is stable at the usual processing temperatures, has a negligible odor, may be used in colored and colorless films, and does not affect the printing properties of the vinyl or subsequent heat-sealing operations, it is claimed. About 2% of Antistat "A" in a vinyl composition is effective, Baird Chemical says.

The product is made by A. Boake, Roberts & Co., Ltd., London, England.

Two New Carwin Isocyanates

Two new isocyanates, polyaryl polyisocyanate and n-butylisocyanate, said to be suitable for many new industrial applications, are being offered in semi-commercial quantities by Carwin Co., North Haven, Conn. Polyaryl polyisocyanate, called PAPI-1, is a dark amber, somewhat viscous liquid belonging to the aromatic polyisocyanate family. Because its average functionality is equivalent to that of a tri-isocyanate, the company points out, the material is expected to provide superior utility in many applications involving the reaction of isocyanates with substances containing activated hydrogen atoms.

Such applications include the bonding of rubber and other elastomers to cloth such as nylon and rayon, aiding the manufacturer of neoprene-coated tarpaulins and rubber-coated protective clothing, for example. In the adhesive field, the isocyanate is said to be promising for the construction of tire carcasses and the solution of problems in adhesion inherent in vibration damping mounts for engines. Other possible uses include the improving of the properties of resins and increasing the resiliency

(Continued on page 928)

Philprene* is the name

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Philprene is a good name to remember. It offers you a choice of 16 different polymers and masterbatches. This wide variety enables you to select the characteristics you need.

Call your Philprene technical representative for technical advice and assistance. This is a valuable part of Phillips service. You are invited to take full advantage of Phillips years of experience in the rubber field. Feel free to call on us for help with any of your rubber problems.

CURRENT PHILPRENE RUBBERS

	POLYMERS	PHILBLACK* MASTERBATCHES
HOT	PHILPRENE 1000 PHILPRENE 1001 PHILPRENE 1006 PHILPRENE 1009 PHILPRENE 1018 PHILPRENE 1019	
COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503 NOTE: PHILPRENE 1019 AND 1503 ARE ESPECIALLY DESIGNED FOR THE WIRE AND CABLE INDUSTRY	PHILPRENE 1601 PHILPRENE 1605—Philblack A cold rubber masterbatch
COLD OIL	PHILPRENE 1703 PHILPRENE 1706 PHILPRENE 1708 PHILPRENE 1712	PHILPRENE 1803 similar to GR-S 1801 but incorporating 25 parts Philrich* 5

PHILLIPS CHEMICAL COMPANY
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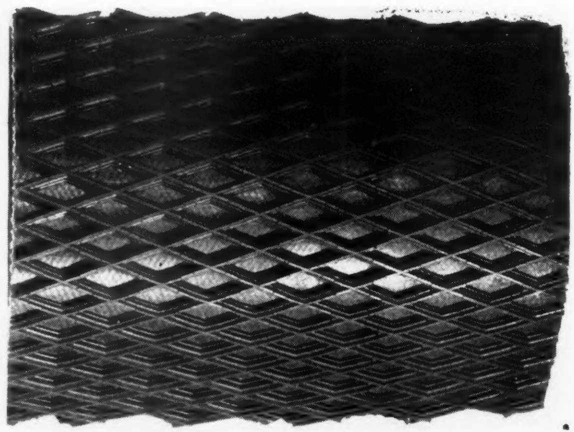
NEW PRODUCTS



Cover design of Wedge-Grip conveyor

Goodyear Package Belt Conveyor

A package belt conveyor said to be designed to handle all types of packages from cans to rough cloth bags on inclines ranging from 30 to 35 degrees is being made available by The Goodyear Tire & Rubber Co., Akron, O. Known as Wedge-Grip, the conveyor has a cover design in the form of "step-down" cross-angle ribs. The ribs are also siped or sliced at regular intervals to provide individual gripping projections. Constructed of a soft, but abrasion-resistant rubber compound, the belt is being made in square-edge slabs and cut to widths up to 60 inches with edges coated black.

U. S. Rubber Super Fleetmaster

A line of truck tires with a steel wire shield between tread and carcass, designed for transit mixers, dump trucks, and heavy-service equipment used in logging, mining, quarrying, and road construction, has been introduced by United States Rubber Co., New York, N. Y.

Called Super Fleetmaster, the tire is available in both tubeless and tubed constructions, and in sizes from 7.50-20 through 11.00-24 with a non-nylon cord body, and from 12.00-24 through 16.00-25 with nylon cord body.

The three-rib tread of the Super Fleetmaster is said to be extra-deep, has wide angle grooves to minimize stone retention, biting edges to reduce skids, and wide shoulder lugs for off-the-road traction. The tire's steel shield virtually eliminates groove cracking, U. S. Rubber claims.

Vibrasorb V-Belt

A rubber V-belt said to absorb 24% more vibration than belts presently rated as low vibration belts is being made available to equipment manufacturers by B. F. Goodrich Industrial Products Co., Akron, O. Dubbed Vibrasorb, the belt features what the company calls "built-in spring action." Reduction of both vibration and noise level by more than 40% on evaporative air-cooling equipment of Wright Mfg. Co., Phoenix, Ariz., is claimed for the new belt. Its flex life is also said to be 90% greater than that of standard V-belts.

TECHNICAL BOOKS

BOOK REVIEWS

"Polymer Processes." C. E. Schildknecht, Editor. Interscience Publishers, Inc., New York, N. Y. 1956. Cloth cover, 6 by 9 inches, 914 pages, illustrated. Price $19.50.

This book is Volume 10 in the High Polymer Series of monographs on the chemistry, physics, and technology of high polymeric substances. More than half of its 18 chapters describe primarily the various types of polymerizations and polymer properties—an introduction to free radical polymerizations; polymerizations in bulk, in suspension, in emulsion, in solution; ionic polmerizations; polyamides and polyesters; condensations with formaldehyde; cellulose and cellulose derivatives; epoxy resins and polysulfide polymers. The remaining chapters deal primarily with technology—new adhesives; stabilization of polymers; paste and latex techniques; compounding and processing of rubbers and resins; polymer reinforcement; and the spinning and drawing of fibers.

The editor has succeeded in attracting a notable list of contributors—some, international figures in the polymer field; others, experienced and competent in the fields they review, but currently less well known. The editor found it necessary to write four chapters outright and collaborate on the fifth, however, to give the desired coverage. Throughout the book, the original aim suggested by Prof. Herman Mark—to bridge the gap between theory and practice—is kept in mind.

Professor Schildknecht mentions, and I agree, that "the contributions of technology and business toward theoretical growth tend to be underrated in our time." In certain areas, the art is far ahead of the scientific interpretation, and much of this art is unpublished for sound business reasons. Yet there is an area open to public view, the patent literature, and frequent references are made to this in most of the chapters. Only the country and patent number (and sometimes the ownership) under discussion are shown. I think it would have been very worthwhile if the original filing date and date of issue had been included. A successful effort has been made to include very recent work, for example, work on ionic polymerization published as recently as October, 1955.

The subject index is adequate and includes a number of registered trade names which will be of convenience to many readers. The printing and paper are first rate, and the substantial binding is uniform with the other volumes of the Series.

Professor Schildknecht and his collaborating authors have made available in convenient form a vast amount of work done both in academic and industrial circles which will be widely appreciated by technologists and research workers alike in the high polymer field, who will find this book a worthy addition to their library.

E. B. Newton

"Techniques of Plant Maintenance and Engineering—1956." Clapp & Poliak, Inc., New York, N. Y. Cloth cover, 8½ by 11¼ inches, 248 pages. Price, $10.

This book contains the proceedings of the technical sessions held during the Seventh National Plant Maintenance and Engineering Show in Philadelphia, Pa., January, 1956. Included are the texts of 16 papers, summaries of 15 round-table discussions, and answers to more than 1,000 specific questions. The chemical, petroleum, and paper manufacturing industries are among the industries particularly dealt with during these technical sessions. Subjects covered by the papers include preventive maintenance, getting maintenance people to work as a team, measuring the effectiveness of maintenance, sanitation, equipment replacement policies, independent contractors, building and yard structure maintenance, use of punched cards, report writing, relation between maintenance and purchasing departments, and forms and reports. There are 110 illustrations and tables.

NEW PUBLICATIONS

"Applications of Velsicol Resins in Rubber Compounding." Technical Bulletin No. 218 (revised). Velsicol Chemical Corp., Chicago, Ill. 20 pages. The physical and electrical properties, test and strain data, and test recipes for the company's thermoplastic hydrocarbon resins, valuable in rubber compounding, are contained in this publication. Velsicol Resins are said to function as plasticizers, softeners, and reinforcing agents, help insulate materials, promote more uniform cures, and aid in the development of non-scorchy stocks.

"Shell Synthetic Rubber." Shell Chemical Corp., synthetic rubber sales division, Torrance, Calif. 36 pages. Specifications and applications of the company's synthetic rubbers are given in this extensively illustrated booklet. Included also are such miscellaneous information as flow diagrams for butadiene, styrene, and copolymer rubber, and a description of Shell's technical service laboratory at Torrance.

"Stan-Tone GPE Colors." #02-134-2-6-56. Harwick Standard Chemical Co., Akron, O. 2 pages. Specifications of the company-distributed granular polyethylene dispersed colors for rubber, vinyls, and polyethylene are listed on this data sheet.

"Silastic 50 and 80." Dow Corning Corp., Midland, Mich. 8 pages. The properties and applications of Silastic 50 and Silastic 80, two general-purpose silicone rubbers, are included in this illustrated brochure.

"Celogen-AZ." Bulletin No. 4. Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 10 pages. The properties and uses of the company's nitrogen blowing agent for polyvinyl chloride are described in this illustrated booklet.

"Tetrone A." F. H. Fritz. Report BL-316. E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del. 4 pages. The obtaining of minimum compression set and good aging properties in nitrile rubber compounds through the use of Tetrone A accelerator is discussed in this report. Test data of the accelerator and an MBTS-sulfur system are compared.

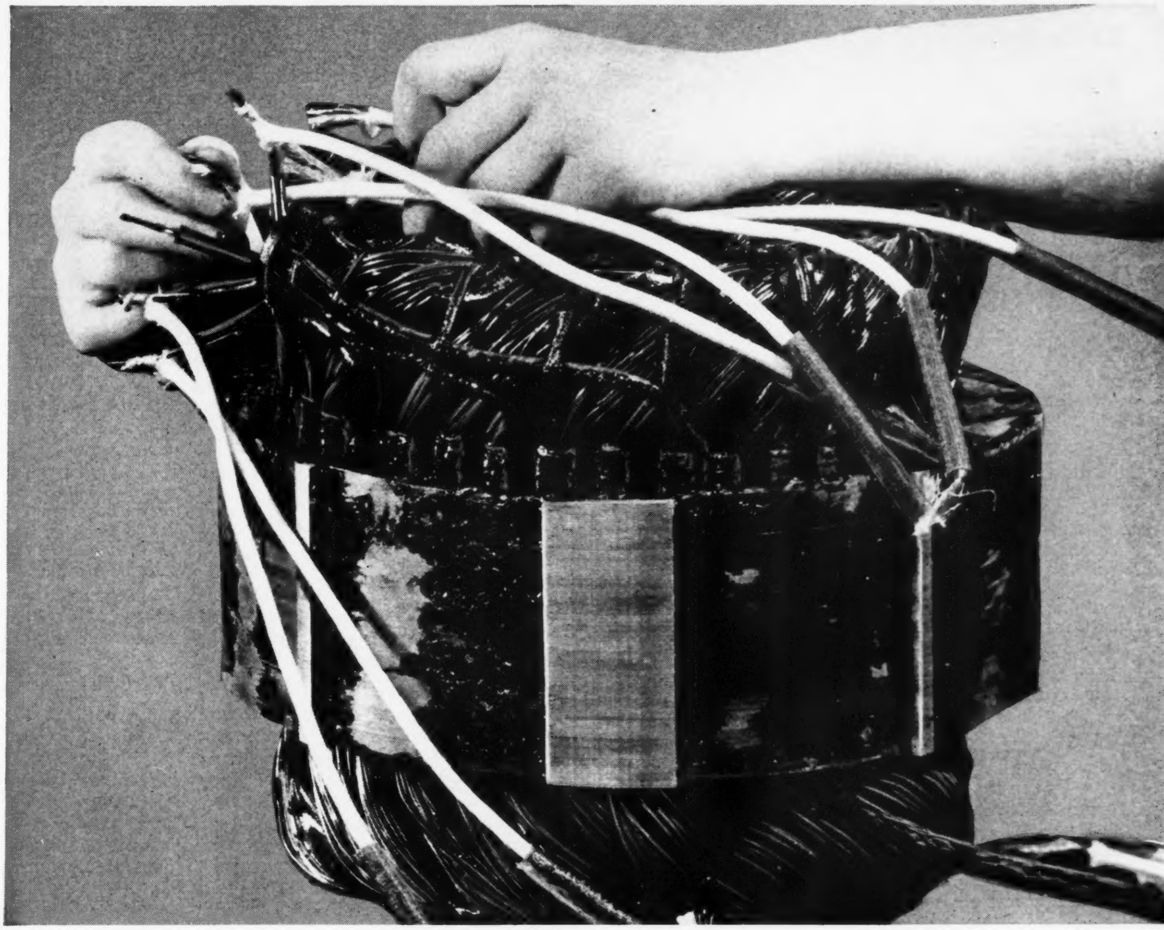
"How to Service Tubeless Truck Tires." The Rubber Manufacturers Association, Inc., New York, N. Y. 12 pages. Detailed illustrated instructions on the servicing of tubeless truck tires are given in this booklet.

"Hystron." Bulletin Hy-2. The General Tire & Rubber Co., chemical division, Akron, O. 12 pages. The processing, properties, compounding, and application of the company's high styrene resin are discussed in this booklet. Recipes for the resin's use in shoe soles, floor tile, mechanical goods, and other products are given.

"Propionaldehyde." F-40110. Carbide & Carbon Chemicals Co., New York, N. Y. 14 pages. The physical properties, specifications, toxicity, and some typical reactions of the company's propionaldehyde, a chemical intermediate for the manufacture of polyesters and other plastics and resinous compounds, are given in these data sheets.

"A Listing of Services and Facilities." Electrical Testing Laboratories, Inc., New York, N. Y. 72 pages. The company's services and facilities for chemical, electrical, electronic, mechanical and physical, photometric, radiometric, and colorometric testing, applied research, and engineering analyses are described in this illustrated booklet.

"Freeze-Drying Equipment for Laboratories." Arthur S. LaPine & Co., Chicago, Ill. 36 pages. Specifications of the company's freeze-drying units, vacuum gages and pumps, bath coolers, refrigerated centrifuges, and related laboratory and small-scale production equipment are reported in this illustrated catalog.



"Empol 1022 Polymerized Fatty Acid." Emery Industries, Inc., organic chemical sales department, Cincinnati, O. 20 pages. The specifications, characteristics, and applications in rubber and other industries of the company's polymerized fatty acid are reported in this booklet.

"Enjay Butyl Compound for Resilient Application." Bulletin 4. Enjay Co., New York, N. Y. 6 pages. Enjay Butyl 217 recipes giving enhanced chemical and physical properties through heat interaction with fine thermal black and plasticizer are included in this technical bulletin, together with compounding recommendations and test data.

"Pliovic AO Dispersion Resin for Organosols and Plastisols." Tech-Book Facts 56-122. The Goodyear Tire & Rubber Co., Inc., chemical division, Akron, O. 1 page. Pliovic AO, the company's copolymer dispersion resin produced by the catalytic emulsion polymerization of vinyl chloride monomer with another modifying monomer, is described in this data sheet, and the advantages of compounding with it are outlined.

"Container Size and Pallet Pattern Selection Criteria for Use on 40" by 48" Pallets." PB 111845. Office of Technical Services, United States Department of Commerce, Washington, D. C. 140 pages. Price, $3. A new graphic method for quick selection of patterns for loading 20,000 sizes of containers on the 40- by 48-inch pallet, devised by the Navy, is described and illustrated here.

"ASTM Standards on Electrical Insulating Materials." 1956. American Society For Testing Materials, Philadelphia, Pa. Paper cover, 6 by 9 inches, 656 pages. Price, $6. The changes in this volume since the 1955 edition include 12 revisions, two new items covering methods of testing silicone insulating varnishes, and a recommended practice for cleaning plastic specimens for insulation resistance testing. The overall compilation includes 83 methods of test and specifications. Proposed recommendations are appended.

"Systematic Classification of Scientific, Technological, and Commercial Information on Rubber." Supplement to Information Bureau Circular No. 430. The Research Association of British Rubber Manufacturers, Shawbury, England. This is a skeleton abridgment of the circular on this subject previously issued.

"Effect of Diameter on Rubber Covered Squeeze Rolls." Report No. 10. Rodney Hunt Machine Co., Orange, Mass. 2 pages. The relation of roll diameter pressure and area of nip contact is discussed in this report. Pointed out is how variations in pressure along the rolls, caused by deflection with resultant uneven wear and possible rupture of the covering, may be corrected by the crowning of the rolls.

"Tygoweld Adhesives." U. S. Stoneware Co., adhesives division, Akron, O. 28 pages. The firm's series of thermosetting adhesives based on synthetic components and applicable to the bonding of rubber and other materials is described in this series of technical bulletins. Included are a general instruction bulletin, a chart of the Tygoweld line, and a summary of recommendations to the design engineer.

"Ovens for Industry." The Kirk & Blum Mfg. Co., Cincinnati, O. 36 pages. The company's industrial oven installations are described in this illustrated catalog. Included are foam rubber dryers, battery plate dryers, twin rock wool ovens and cooling tunnels, metal tube dryers, testing ovens, and ovens for plastisol research, production, and application. Size of each oven and the maximum operating temperature are reported.

"G-4 (Dichlorophene)." Technical Bulletin D-2. Sindar Corp., New York, N. Y. 18 pages. This is a revised bibliography of the literature on dichlorophene, containing abstracts of some 110 scientific trade articles, as well as abstracts of 12 patents.

Publications of the British Rubber Producers' Research Association, Welwyn Garden City, Herts., England:

No. 225. **"Chemical Verification of the Mechanical Degradation Mechanism of Cold Mastication."** G. Ayrey, C. G. Moore, and W. F. Watson. 16 pages. The third in a series of research reports on mastication, this article discusses the verification of the mechanism of cold mastication of natural and synthetic rubber which involves the mechanical rupture of the polymer chain yielding polymer radicals which are stabilized by interaction with radical-acceptor molecules to give the degraded polymer.

No. 226. **"Cylindrically Symmetrical Deformations of Incompressible Elastic Materials Reinforced with Inextensible Cords."** J. E. Adkins. 12 pages. This subject is examined by the author under such topic breakdowns as constraints imposed by sets of cords, stress resultants in a layer of cords, the forces on the composite body, inflation and extension of a cylindrical tube, flexure and extension of a curved block, and the shear and flexure of a cuboid.

No. 228. **"Oxidation of Organic Sulphides: Part V.** The Products of the Reaction of Organic Hydroperoxides with Alk-2-Enyl Sulfides." D. Barnard. 6 pages. The yields of sulfoxides from the reaction of allylically unsaturated sulfides with several organic hydroperoxides have been found to be always less than the theoretical. The dependence of the yields upon sulfide and hydroperoxide structure, the solvent used, and the reaction conditions are discussed.

No. 229. **"Micro-Gel in Latex and Sheet Rubber."** R. Freeman. 10 pages. Paper No. 13 from the "Proceedings of the Third Rubber Technology Conference, June, 1954."

No. 230. **"Natural Rubber Compounds for Intermittent Low-Temperature Service."** W. P. Fletcher, A. N. Gent, and R. I. Wood. 15 pages. Paper No. 47, Third Rubber Technology Conference.

No. 231. **"Theoretical Model for the Elastic Behavior of Filler-Reinforced Vulcanized Rubbers."** L. Mullins and N. R. Tobin. 16 pages. Paper No. 49, Third Rubber Technology Conference.

No. 232. **"Stability of Ammoniated Latex and Soap-Stabilized Emulsions in the Presence of Complex Zinc Salts."** T. S. McRoberts. 12 pages. Paper No. 48, Third Rubber Technology Conference.

No. 233. **"Graft Polymers Derived from Natural Rubber."** G. F. Bloomfield, F. M. Merrett, F. J. Popham, P. McL. Swift. 11 pages. Paper No. 50, Third Rubber Technology Conference.

No. 234. **"Structural Characteristics of the Sulfur Linkage in Natural Rubber Vulcanizates."** L. C. Bateman, R. W. Glazebrook, C. G. Moore, R. W. Saville. 11 pages. Paper No. 51, Third Rubber Technology Conference.

No. 235. **"Interaction of Rubber and Fillers during Cold Milling."** W. F. Watson. 12 pages. Paper No. 86, Third Rubber Technology Conference.

No. 236. **"The Polymerization of Vinyl Monomers in Natural Rubber Latex."** G. F. Bloomfield and P. McL. Swift. 7 pages. Practical methods are described for polymerizing methacrylic esters, styrene, and other vinyl monomers in natural rubber latex. High conversions were obtained using activated initiating systems at moderate temperatures. High proportions of surface-active stabilizers favor polymerization of the vinyl monomer independently of the rubber phase to give a rubber-polymer mixture. With a low proportion of stabilizer most of the polymerization occurs within the swollen rubber particles.

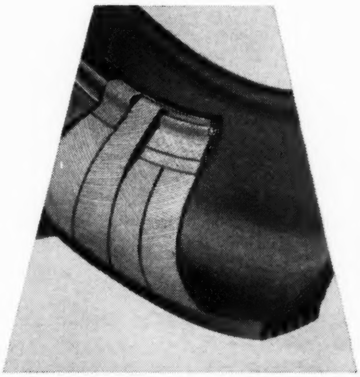
No. 237 **"Oxidation of Organic Sulfides: Part VI.** Interaction of Hydroperoxides with Unsaturated Sulfides." K. R. Hargrave. 13 pages. In alcohol solvents the reactions of two unsaturated sulfides with hydroperoxides were found to show all the features previously observed for the saturated sulfides. In benzene, however, the reaction with *t*-butyl hydroperoxide led to a non-quantitative yield of sulfoxide. Kinetic and product investigations indicated that the reaction occurs in two successive steps, which are described. There is no oxygen-catalyzed reaction between *t*-butyl hydroperoxide and *cyclo*hexenyl methyl sulfide. It is inferred that the unsaturated sulfide is a free radical inhibitor, and the relevance of this to its autoxidation characteristics is discussed.

"New Inorganic Colors." Ferro Corp., Cleveland, O. Data and specifications of the firm's inorganic pigments appear on this color chart folder.

Wider range of high-strength yarns and fibers than any other brand

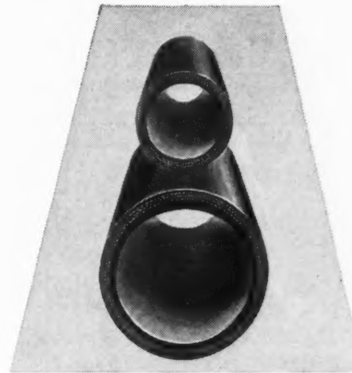
American Viscose Corporation, the nation's largest producer of rayon, manufactures a wider range of high-strength yarns and fibers than any other company.

Here are a few of the hundreds of applications of AVISCO rayon that make industrial products stronger, more versatile, longer lasting:

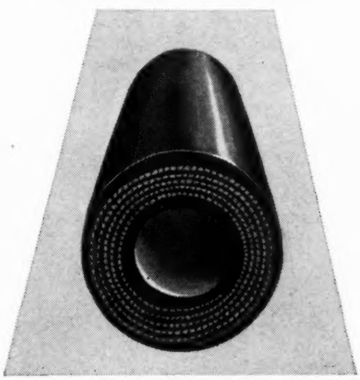


Rayon chafer fabric woven from continuous filament Rayflex yarn or high-strength Viscose 32-A staple yarns.

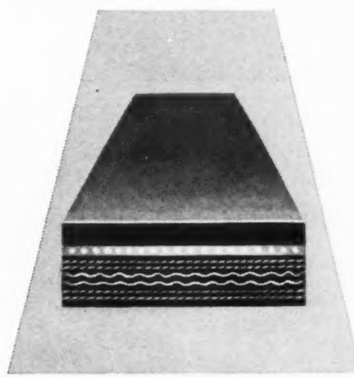
Garden hose—rubber or plastic—reinforced with either knit or braided rayon tire yarn for high strength, durability.



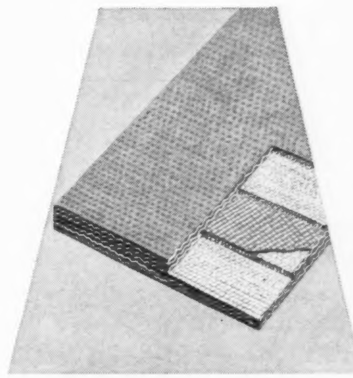
Automobile heater and radiator hose reinforced with knitted high-strength tire yarn.



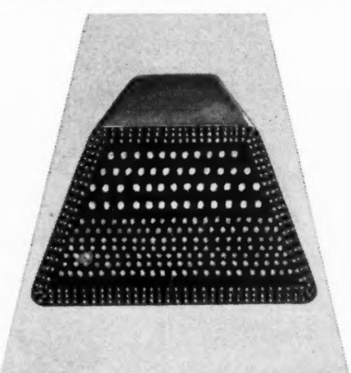
Spiral-wrapped hose made from fabric woven from Viscose 32-A high-strength staple. Wide range of uses wherever high bursting strength is required.



Conveyor belt reinforced with Super Rayflex rayon in cord or duck construction. Also made with fabric of Viscose 32-A high-strength rayon staple.



Heavy-duty power transmission belt with multiple plies of Super Rayflex for maximum strength and high operating efficiency.



V-belt, constructed of layers of tire fabric or individual cords.

We would be happy to discuss with you how you can use AVISCO rayon to strengthen your business.

American Viscose Corporation
350 Fifth Avenue
New York 1, N. Y.

AVISCO® RAYON

AVISCO *is the trademark of American Viscose Corporation*

"Sterling V in Nitrile Rubber Oil Seals." Technical Service Laboratory Bulletin No. GD-15. Godfrey L. Cabot, Inc., Cambridge, Mass. 5 pages. The company's Sterling V and Pelletex carbon blacks are compared in nitrile rubber recipes for sealing rings, O-rings, gaskets, bushings, and grommets. Postcure test data are given.

"Dayton Natural and Synthetic Rubber Products for Textile Machinery." The Dayton Rubber Co., textile division, Dayton, O. 28 pages. How the company produces rubberized textile machinery products at its Waynesville, N. C., plant is described in this illustrated brochure.

"Beta Profiler." Instrumentation Data Sheet No. 10.9-2. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. 2 pages. The firm's device for continuously measuring the weight per unit area across the entire width of a reel of such materials as rubber and plastics film and sheeting is described in this data sheet.

"Forming of Plio-Tuf Sheet." Processing Bulletin 56-137. The Goodyear Tire & Rubber Co., chemical division, Akron, O. 8 pages. Technical data on the forming of the company's modified styrene resin thermoplastic sheet are discussed and illustrated in this publication.

Publications of B. F. Goodrich Chemical Co., Cleveland, O.

"Hycar Technical Newsletter." Vol. V, No. 3. 8 pages. Hycar recipes for compounding to Aeronautical Materials Specifications 3213F and 7271, Bendix Products Division Specification ES 0739, and Carter Carburetor Specification E-1-24 are contained in this Newsletter, together with postcure data and other information.

"Hycar Latex Newsletter." Issue No. 13. 8 pages. This issue reports on a laboratory investigation on the effect of pH on the properties of textile resin finishes modified with Hycar latex. Results point to the importance of maintaining fairly specific pH levels for acceptable bath stability and optimum properties in the treated fabric. A recipe and discussion of a washable Hycar top-grain leather finish for silicone treated leather are also included in the issue.

"Geon Latices." Service Bulletin L-7. 22 pages. This booklet describes the properties, applications, and compounding of Geon latices, which are colloidal dispersions of vinyl chloride polymers and copolymers in water, designed primarily for the coating, impregnation, and saturation of fibrous materials.

"Geon Solution Resins." Service Bulletin G-15. 16 pages. The preparation and properties of solutions of the company's vinyl resins for the coating of a variety of materials are discussed in this booklet. Also described is the compounding of the resin solution to obtain special properties.

Carwin Isocyanates

(Continued from page 916)

and raising the heat distortion point of urethane flexible and rigid foams, respectively. Theoretical average molecular weight of the isocyanate is 384, viscosity @ 21° C. is about 700 cps., and a 50% solution can be obtained in such solvents as ethyl acetate, butylacetate, benzene, toluene, chlorobenzene, and o-dichlorobenzene.

N-butylisocyanate, called BUNCO, is a water-white, liquid aliphatic monoisocyanate, capable of undergoing all the reactions typical of this class of compound, but less sensitive to moisture than the aromatic members of the family. BUNCO offers a simple route to substitute ureas and urethanes, the company says. Applications are expected to include waterproofing of textiles and proteins, increasing the wear resistance of wool, and in rapid tanning of hides and skins. Specific gravity of the isocyanate is 0.880; melting point is about −50° C.; and boiling point is 113-116° C.

Technical bulletins describing both isocyanates are available from the company.

MARKET REVIEWS

Natural Rubber

The crisis over Egypt's nationalization of the Suez Canal dominated all other influences on natural rubber prices during the July 16-August 15 period. On both the spot and futures markets, prices rose and fell as the situation worsened and abated.

On the New York spot market, RSS #1, beginning the period at 34.25¢ a pound and easing to a period-low of 33.38¢ on July 20, climbed almost 5¢ by August 6 when it recorded a period-high of 38¢. Three days later, as the crisis lessened, the price dropped to 35¢, ending the period at 36¢.

Trading on the New York Commodity Exchange should have been heavier than normal, but caution prevailed. A total of 46,500 tons was exchanged in all three contracts: RSS #1, Rubber-Standard, and Rex. The expiring #1 Contract accounted for 36,090 tons; Rubber-Standard for 3,940 tons; and Rex, in existence since August 1, for 6,470 tons. There were 23 trading days during the period.

Week-end closing Commodity Exchange futures prices for all three rubber contracts were:

RSS #1 Contract

	June 22	July 20	July 27	Aug. 3	Aug. 10
July	30.65	34.50	42.00	....	....
Sept.	29.20	31.95	35.00	36.25	36.80
Dec.	27.85	30.05	32.79	34.00	35.50
Total weekly sales, tons	7,230	6,510	9,430	9,710	7,670

Rubber-Standard Contract

	July 20	July 27	Aug. 3	Aug. 10
July	34.25	40.00	....	....
Sept.	31.25	33.90	34.25	35.00
Dec.	29.40	31.70	32.55	33.50
1957				
Mar.	28.70	30.40	30.75	32.25
May	28.00	29.50	29.90	31.50
July	27.45	28.80	29.20	30.50
Sept.	....	....	28.30	29.50
Total weekly sales, tons	370	760	1,060	1,230

Rex Contract

	Aug. 3	Aug. 10
Sept.	34.50	35.50
Nov.	33.85	35.00
1957		
Jan.	32.60	33.90
Mar.	31.35	32.90
May	30.35	31.90
July	29.30	31.00
Sept.	28.40	30.10
Total weekly sales, tons	1,240	3,530

On the physical market, average July monthly spot prices for representative grades were as follows: RSS #1, 34.47¢ a pound; RSS #3, 33.49¢; #3 Amber Blankets, 27.59¢; and Flat Bark, 20.35¢. For the first half of August, the #1 grade averaged 36.38¢.

New York Spot Market
Week-End Closing Prices

	June 22	July 20	July 27	Aug. 3	Aug. 10
RSS: #1	31.25	33.38	37.00	36.38	36.00
2	31.00	33.00	36.00	35.63	35.50
3	30.75	32.63	35.25	35.13	35.00
Latex Crepe					
#1 Thick	37.88	38.13	42.25	43.00	46.00
Thin	37.88	38.13	42.25	43.00	46.00
#3 Amber Blankets	29.75	26.75	28.75	30.00	30.00
Thin Brown Crepe	24.50	26.25	28.13	29.38	29.50
Flat Bark	19.50	19.75	21.13	22.75	23.38

Synthetic Rubber

Reports from synthetic producers indicate that sales during July and August fell considerably below the levels of May and June. Consumption of all types of synthetic rubber in the United States during July, the latest figures available as of this writing, was 57,022 long tons, according to estimates of The Rubber Manufacturers Association, Inc., the lowest monthly level since November, 1954. Indicative of the July slump was the fact that only 48,346 long tons of SBR were consumed.

Production was also off, although not so much as consumption. Except for June's production of 85,167 long tons of synthetic rubber, July's figure, at 87,811 long tons, was the lowest volume since September, 1955. Production of SBR during July was 70,426 long tons; while butyl production was 7,181. Incidentally, the butyl figure was the highest monthly production since April, 1953, a possible indication of faith in the future demand for that-type rubber.

In spite of the soft summer market for synthetic rubber, producers continue to announce new expansions. The latest are Firestone, which is boosting its Lake Charles plant SBR capacity from 150,000 long tons a year to 190,000 long tons; and Goodrich-Gulf and Texas-U.S., who are increasing the butadiene output of their Port Neches facilities from 200,000 to 300,000 long tons a year in anticipation of greater SBR demand.

Despite the July and August downcurve, producers are optimistic about fall business. Higher volume is already seen for September. Fall and winter industrial levels are expected to be encouraging.

The crisis over the Suez Canal seizure by the Egyptians has also entered the thinking of producers. If the situation becomes more critical, consumers, denied ready access to natural rubber, may turn more and more to the synthetic product.

Higher prices for synthetic may also be in the offing. Rising material and labor costs have stiffened pressures for price boosts. Although the summer lull has temporarily ruled out such price increases, they may develop in the next few months. If they do, they will be small, in any case.

Latex

Relatively stagnant conditions in the natural and synthetic markets prevailed throughout the July 16-August 15 period. In natural latices, the failure of the price advance brought about by the crisis over Egypt's seizure of the Suez Canal was believed to indicate that consumers are generally well covered for their near requirements and were awaiting developments before considering more forward purchases.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 39 to 44¢ per pound solids. Prices of synthetic latices remained the same, being quoted as SBR, 26-32.3¢; neoprene, 37-47¢; and N-type, 46-54¢.

Final May and preliminary June domestic statistics for all latices were reported by U. S. Department of Commerce as:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
May	0	5,731	5,239	21,234
June	0	....	4,708	20,705
SBR				
May	4,929	37	4,745	7,516
June	4,671	..	4,101	7,277
Neoprene				
May	939	0	778	1,218
June	907	0	640	1,251
Nitrile				
May	614	0	691	2,194
June	543	0	471	1,527

Reclaimed Rubber

The reclaimed rubber market continued in its summer doldrums during the July 16-August 15 period. Vacations and the slowdown in the automotive industry contributed to the lethargy. Improved conditions are not expected before well into September.

Prices were unchanged.

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	**$0.105**
Fourth line	**.0925**
Inner tube: black	**.15**
Red	**.21**
Butyl	.14
Pure gum, light colored	**.23**
Mechanical, light colored	**.135**

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

CYANAMID RUBBER Chem Lines

NO. 6 OF A SERIES

Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

Growing Popularity of Chemical Peptizers

The use of chemical peptizers as an aid in the mastication of rubber hydrocarbon, either of the natural or synthetic type, has risen steadily since their inception. Manufacturers of rubber products have learned that the small cost of these materials is negligible compared to the savings possible in the reduction of time in heavy masticating equipment, and the reduced power required for rubber breakdown and subsequent processing.

Pepton® 22 Plasticizer has become recognized as an outstanding product for this task. Its increased use has required that we expand our facilities several times for manufacturing this product, and we are now looking toward still more expansion to meet the growing demand.

Pepton® 65 and Pepton 65B Plasticizers have been added to our line to facilitate the low-temperature breakdown of natural rubber. Pepton 22 does not exert its full potential until temperatures of 240° F or greater are reached. Pepton 65, however, does an excellent job of peptizing natural rubber breakdown at temperatures as low as 150° F.

Certainly if you have a problem in your plant which requires rapid and controlled breakdown of rubber, it will pay you to investigate these products.

Incidents Illustrating Uses of Pepton 22 & Pepton 65

An amusing experience was related by one of our customers. It was amusing to us, but not to him at the time.

Investigation of the reason for poor dispersion in several tread stock batches revealed departure from specified mixing procedure. When questioned, the Banbury operator admitted the changes but suggested the batches mixed better by his method. The laboratory man insisted that the specification be followed and the operator agreed but muttered in low tones, "You're not going to like it."

The laboratory man followed the loading of the Banbury and quickly ran down below to watch the batch being dumped onto the mill. We guess he kept right on running because he was greeted at the mill by a shower of crumbled rubber and a spray of carbon black. As you can understand, the makeshift procedure of mixing established by the Banbury man was reinstated until the situation was studied thoroughly.

This batch happened to contain oil-extended GR–S. One of the corrective measures that could have been adopted was the use of 1 to 2% Pepton 22, added as soon as possible after the oil-extended GR–S was loaded in the Banbury. Pepton 22 greatly aids the breakdown of the polymer and makes it more receptive to the carbon black addition. Good dispersion is obtained, Mooney viscosity of the mixed stock is reduced and improved processing results.

If you have a "crumbled batch" problem, try Pepton 22.

A useful hint was passed on to us by another customer. He praised Pepton 22 as an aid to breakdown of natural rubber in high-speed Banburys. However, he said he had to work with low-speed Banburys from time to time and found that under these conditions an economical equivalent amount of Pepton 65 (approximately two-thirds the dosage of Pepton 22) did a much more efficient job. The temperatures attained in slow-speed mixing probably do not reach the range at which Pepton 22 exerts its maximum efficiency.

A Common Yardstick

One of the most important characteristics of modern industrial progress has been standardization. Our abundance of material things and our high standard of living may be attributed to low-cost mass-production techniques. Standardization has been a vital factor in making this system possible. Although we all admire the nonconformer and the individualist, we have recognized and accepted the need for uniformity in modern production methods.

The rubber industry has paralleled the automobile industry in this quest for standardization. As an example, we can point to the Tire and Rim Association standards of dimensional limits; Rubber Reserve's standardization of type of synthetic rubber, which has been adhered to even under private ownership of rubber producing plants; and the A.S.T.M. standards for testing the physical and chemical properties of finished rubber products.

Until recently there has been little industry-wide effort to standardize the specifications for rubber chemicals. Recognizing the desirability of industry standards, representatives of major producers of rubber chemicals have unanimously agreed to work together as an unofficial task force to study the problem of establishing such a code and to make recommendations.

Melting range is one of the most widely used criteria for the evaluation of the quality of rubber chemicals. In published literature, values for any one product varied so widely that the task force first directed its attention to this determination. After the problem was defined and a tentative test method established, a program of collaborative study was carried out. A paper describing this study and its results is in preparation for proposed publication in an A.S.T.M. journal.

Encouraged by the success of their initial effort, the task force is now turning its attention to other specification items and is taking steps to obtain official recognition by the A.S.T.M.

Scrap Rubber

Continued quiet conditions prevailed on the scrap rubber market during the period from July 16 to August 15. Naugatuck and other mills were shut down for the annual summer vacation. Dealers have not reported a surplus inventory, and the market, therefore, was expected to become more active at the end of August and through September.

During the period, mixed auto tire suffered price declines of about $1 a ton. The price of black auto tubes also declined fractionally. Period-end buying prices for scrap rubber grades were as follows:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$11.00/14.00	$14.00
S.A.G. auto tires	Nom.	Nom.
Truck tires	Nom.	Nom.
Peelings, No. 1	40.00	40.00
2	Nom.	Nom.
3	16.00	19.00
Tire buffing	Nom.	Nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.25	2.25
Black	5.25	5.50
Butyl	Nom.	Nom.
Red	6.50	6.75

Cotton Fabrics

Trading in industrial fabrics picked up somewhat during the period from July 16 to August 15, but overall prices at period-end were still slightly softer than they had been a month before.

Stimulated buying was reported on the part of coaters and automotive users by industrial wide fabric sources, although in relatively modest quantities. The renewed activity was said to herald a promising market revival. Most mills anticipate an improvement in demand in the weeks ahead.

At period-end, an improvement in inquiry was observed, with some sales taking place. These sales consisted of small yardages for nearby fill-in purposes. Buyers still seemed hesitant to commit themselves too far toward the future.

Period-end prices of cotton fabrics follow:

COTTON FABRICS

Drills		
59-inch 1.85 yd.	*yd.*	$0.36
2.25-yd.		.315
Ducks		
38-inch 1.78-yd. S.F.	*yd.*	nom.
2.00-yd. D.F.		.34
51.5-inch, 1.35-yd. S.F.		.4963
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	*yd.*	.255
3.65-yd.		.1625
Raincoat Fabrics		
Printcloth, 38½-in., 64x60, 5.35-yd.	*yd.*	.1375
6.25 yd.		.12
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.2325
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	*yd.*	.70
11.65-oz./sq. yd. S.		.61
10.80-oz./sq. yd. S.		.6575
8.9-oz./sq. yd. S.		.67
Other Fabrics		
Headlining, 59-in., 1.65-yd., 2-ply	*yd.*	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 53-inch, 1.32-yd.		.5575
58-inch, 1.21-yd.		.61
Tire Cord		
1242 Standard	*lb.*	.83

Rayon

Total calculated production of rayon and acetate yarn during July was 56,500,000 pounds, of which 27,600,000 pounds were regular-tenacity yarn and 28,900,000 pounds were high-tenacity rayon yarn. June production had been: total, 54,900,000 pounds; regular-tenacity, 27,200,000 pounds; and high-tenacity, 27,700,000 pounds.

Total domestic shipments for July were 51,900,000 pounds, consisting of 24,300,000 pounds of regular-tenacity yarn and 27,600,000 pounds of high-tenacity rayon yarn. June shipments had been: total, 50,900,000 pounds; regular-tenacity, 25,000,000 pounds; and high-tenacity, 25,900,000 pounds.

Total end-of-July stocks were 67,500,000 pounds, of which 52,500,000 pounds were regular-tenacity yarn and 15,000,000 pounds were high-tenacity rayon yarn. End-of-June stocks had been: total 64,000,000 pounds; regular-tenacity, 49,800,000 pounds; and high-tenacity, 14,200,000 pounds.

Current prices of tire yarns and fabrics follow:

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/480	$0.62/$0.67
1100/490	.62/.67
1150/490	.67
1165/480	.68
1230/490	.67
1650/720	.58/.64
1650/980	.58/.64
1875/980	.64
2200/960	.58/.63
2200/980	.58/.63
2200/1466	.67
4400/2934	.63
Super-High-Tenacity	
1650/720	.63/.69
1900/720	.69
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

Netherlands

(Continued from page 908)

authorities the advantages of using its facilities for plastic research instead of transferring its scientists to Germany to do research on synthetic rubber there, as they were planning to do. So the Plastics Institute at Delft was born, largely to cover up secret investigations on rubber, which after the war helped the Stichting toward new prestige.

Dr. Houwink has written several other books in addition to those mentioned; he is a Fellow of the IRI and an honorary Fellow of the Society of Industrial Chemistry, Paris; he has held numerous honorary appointments.

The Stichting will long remember him, for as Dr. van Rossem said in a farewell article in the July issue of *Rubber,* the Stichting's organ, Houwink's appointment as director general of Rubber Stichting was a blessing for the organization.

France

1956 Chemical Convention Rubber and Plastics Exhibit

The Convention of Chemical Sciences 1956, which will be held in Paris, November 18-December 3, at the same time as the Fourth Chemical, Rubber, and Plastics Exhibition, will include several important meetings. The twenty-ninth International Congress of Industrial Chemistry will hold sessions of its 21 sections every morning during the period November 18-24; in the afternoons of this same period will be held meetings of the First Congress of the European Corrosion Federation, whose work is divided into eight sections. The eleventh European Conference of Chemical Engineering, scheduled for November 22-24, will include three symposia.

The Parisian Technical Days will include a series of specialized symposia on plastics; rubber; measurements, control and regulation; analysis and tests; high-grade and special steels; polar and tropical equipment. Each day a question of immediate interest will be discussed during the meetings taking place November 26-30, and also on December 3.

The fourth Chemical, Rubber and Plastics Exhibition, arranged for November 22-December 3, is to have seven sections: laboratory equipment; engineering and general equipment; special apparatus; raw materials and industrial products; natural and synthetic rubber industries; plastics industries; organization.

Mexico

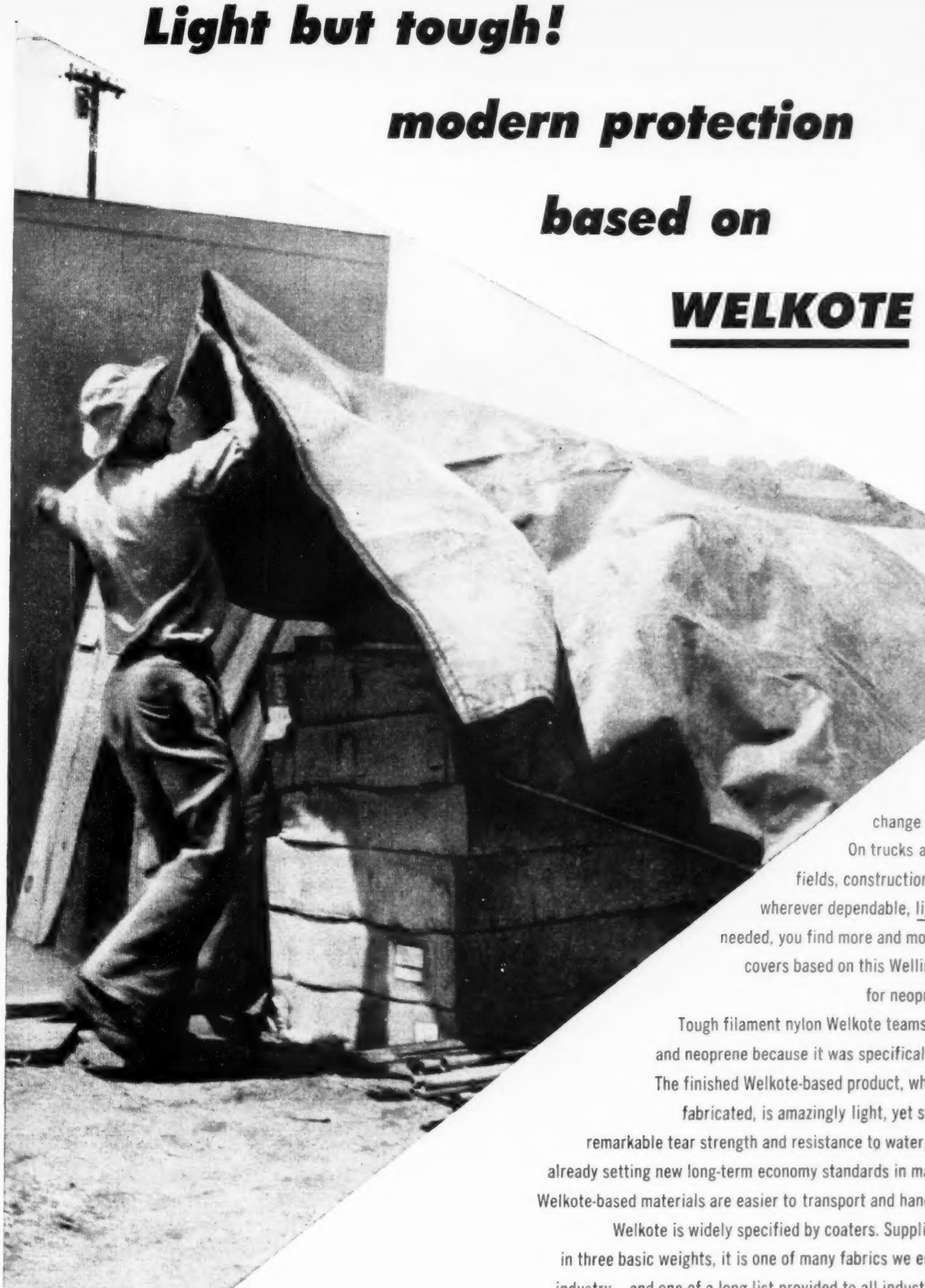
The manufacture of rubber goods in Mexico has been steadily developing in recent years as the growing import figures of raw rubber indicate. In 1954, a total of 21,470 tons, valued at 121,600,000 pesos, was imported; in 1955, the corresponding amounts were 22,835 tons and 180,500,000 pesos, respectively. Figures for the first four months of the current year came to 8,315 tons, value 70,000,000 pesos, so that total imports for the year may well be over 24,000 tons, costing some 200,000,000 pesos.

In the face of rising expenditure for foreign rubber, government authorities appear to be considering the possibilities of local sources of raw rubber, and from what one can gather from local press reports, there has been talk about a plan for large-scale rubber cultivation in the State of Tabasco.

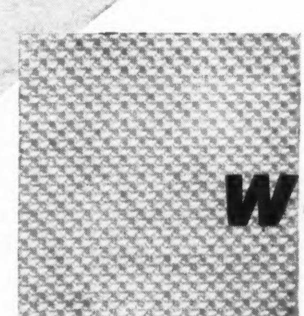
Light but tough!

modern protection based on WELKOTE

This 10' x 14' Welkote-based tarp is an easy load for one man.



Welkote is at the very heart of the big change in protective coverings. On trucks and railroads, on playing fields, construction sites and oil fields . . . wherever dependable, lightweight protection is needed, you find more and more tarpaulins, tents and covers based on this Wellington Sears base fabric for neoprene and vinyl coatings. Tough filament nylon Welkote teams up perfectly with vinyl and neoprene because it was specifically engineered for them. The finished Welkote-based product, when properly coated and fabricated, is amazingly light, yet strong beyond belief. Its remarkable tear strength and resistance to water, wear and weather, are already setting new long-term economy standards in many industries. Further, Welkote-based materials are easier to transport and handle (see picture above). Welkote is widely specified by coaters. Supplied by Wellington Sears in three basic weights, it is one of many fabrics we engineer for the coating industry—and one of a long list provided to all industries for over a century. This extensive experience is yours to work with in all our base fabrics, available for every coating use at Wellington Sears. For illustrated booklet, write Dept. H-9.



Wellington Sears

FIRST In Fabrics For Industry

For Mechanical Goods, Coated Materials, Tires, Footwear and Other Rubber Products

WEST POINT TEXTILES

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

Synthetic Rubbers and Latices*

Acrylic Types

Hycar 4021	$1.35[c]
4501	.81[c]

Fluorocarbon Types

Kel-F Elastomer *lb.*	15.00 / 16.00

Isobutylene Types

Enjay Butyl 035, 150, 215, 217, 218, 325	.23[a]
165, 265, 267, 268, 365	.24[a]
Hycar 2202	.65[c]
Polysar Butyl 100, 200, 300, 400	.245[c]
101	.2775[a]
301	.255[c]
Vistanex	.45[a]

Neoprene

Neoprene Type AC, CG	.55[a]
GN, GN-A	.41[a]
GRT, S	.42[a]
KNR	.75[a]
W	.39[a]
WRT	.45[a]

Latices

Neoprene Latex 571, 842-A	.37[a]
572	.39[a]
601-A	.40[a]
735, 736	.38[a]
950	.47[a]

Nitrile Types

Butaprene NAA	.54[a]
NF	.49[a]
NL	.50[a]
NXM	.58[a]
Chemigum N1NS	.64[b]
N3NS, N5	.58[b]
N6, N-6B, N7	.50[b]
Hycar 1001, 1041	.58[c]
1002, 1042, 1043	.50[c]
1014, 1312	.60[c]
1411	.62[c]
1432	.59[c]
1441	.64[c]
Paracril AJ	.485[c]
B, BJ, BLT	.50[c]
C	.58[c]
CV	.59[c]
D	.65[c]
18-80	.60[c]
Polysar Krynac 800, 802, 803	.50[c]
801	.58[c]

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
*Prices are per pound carload or tank-car dry weight unless otherwise specified.
†Listed below are the new SBR type synthetic rubbers and latices trade names and the chief sales offices of their producers or distributors.

ASRC	—American Synthetic Rubber Corp., 500 Fifth Ave., New York 36, N. Y.
Baytown	—United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor).
Butaprene, FRS	—Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O.
Copo	—Copolymer Rubber & Chemical Corp., P. O. Box 1029, Baton Rouge 1, La.
G-G	—Goodrich-Gulf Chemicals, Inc., 3121 Euclid Ave., Cleveland 15, O.
Naugapol, Naugatex	—Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
Philprene	—Phillips Chemical Co., Rubber Chemicals Division, 318 Water St., Akron 8, O.
Plioflex	—Goodyear Tire & Rubber Co., Chemical Division, Akron 16, O.
Pliolite Latex	—Goodyear Tire & Rubber Co., Chemical Division. Also distributed by General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass.
Polysar	—Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc., 60 E. 42nd St., New York 17, N. Y. (distributor).
S-	—Shell Chemical Corp., Synthetic Rubber Sales Division, 30 W. 50th St., New York 20, N. Y.
Synpol	—Texas-U. S. Chemical Co., Port Neches, Tex. (producer); Naugatuck Chemical (distributor).
‡SBR	—Styrene butadiene rubber.
§BR	—Butadiene rubber.

Latices

Butaprene N-300	$0.46[b]
N-400, N-401	.54[b]
Chemigum	.49[b]
235 CHS, 236	.54[b]
245 B, 245 CHS, 246	.46[b]
Hycar 1512, 1552, 1562, 1577	.46[c]
1551, 1561	.54[c]
1571	.59[c]
1572	.51[c]
Nitrex 2612, 2614	.46[a]
2615	.51[a]

Polyethylene Type

Hypalon 20 *lb.*	.85 / .88

Polysulfide Types

Thiokol LP-2, -3, -32, -33	.96[a]
-8, -38	1.25[a]
PR-1	.95[a]
Type-A	.47[a]
FA	.69[a]
ST	1.00[a]

Latices

Thiokol Latex (dry wt.)	
Type MF	.85[a]
MX	.70[a]
WD-2	.92[a]
-5	.95[a]
-6, -7	.70[a]

Silicone Types

GE (compounded)	2.25[a]/4.10[a]
Silicone gum (not compounded)	3.85[a]/4.90[a]
Silastic (compounded)	1.95[b]/3.65[b]
(Partly compounded)	3.38[b]/3.90[b]
(Uncompounded)	3.85[b]/4.50[b]
Union Carbide (compounds)	2.35[b]/3.20[b]
(Gums)	3.85[b]/4.25[b]

Styrene Types†

Hot SBR‡

ASRC 1000, 1001, 1004, 1006	.241[c]
FR-S 1000, 1001, 1004, 1006	.241[c]
1009	.2475[c]
1010	.26[c]
1012	.2425[c]
1013	.25[c]
1014	.281[c]
1015	.291[c]
G-G 1000, 1001, 1006	.241[c]
Naugapol 1016, 1019	.265[b]
1018	.27[b]
1021	.30[b]
1022	.28[b]
1023	.285[b]
Philprene 1000, 1001, 1006	.241[b]
1009	.255[b]
1018	.27[b]
1019	.265[b]
Plioflex 1006	.241[c]
Polysar S, S-50, S-65	.241[c]
SS-250	.30[c]
S-X-371	.255[c]
S-1000, -1001, -1006, -1013	.23[a]
-1002, -1011	.2325[a]
Synpol 1000, 1001, 1006, 1061	.241[b]
1002	.2435[b]
1007, 1012	.2425[b]
1009	.2475[b]
1013	.25[b]

Hot SBR Black Masterbatch

S-1100	.185[a]

Cold SBR

ASRC 1500, 1502	.241[c]
Copo 1500, 1502	.241[c]
FR-S 1500, 1502	.241[c]
G-G 1500, 1501, 1502	.241[c]
Naugapol 1503	.27[b]
1504	.295[b]
Philprene 1500, 1502	.241[b]
1503	.2625[b]
Plioflex	$0.241[c]
Polysar Krylene	.241[c]
S-1500, -1501, -1502	.23[b]
Synpol 1500, 1502, 1551	.241[b]

Cold SBR Black Masterbatch

Baytown 1600, 1601, 1602	.185[a]
Philprene 1601	.191[b]
1605	.187[b]
S-1600, -1601, -1602	.18[a]

Cold SBR Oil Masterbatch

ASRC 1703	.206[c]
1708	.191[c]
FR-S 1703	.206[c]
1705	.2035[c]
1712	.1885[c]
G-G 1703	.206[c]
1705	.2035[c]
1707	.191[c]
1710, 1712	.1885[c]
Philprene 1703	.206[b]
1706	.203[b]
1708	.191[b]
1712	.188[b]
Plioflex 1703, 1773	.206[c]
1710	.1885[c]
1778	.191[c]
Polysar Krynol 651	.1885[c]
652	.191[c]
S-1703	.195[a]
-1706	.1925[a]
-1707	.18[a]
-1709, -1712	.1775[a]
Synpol 1703	.2075[b]
1707	.1925[b]
1708	.195[b]
1711	.19[b]

Cold SBR Oil-Black Masterbatch

Baytown 1801	.17[a]
Philprene 1803	.172[b]
1806	.176[b]
S-1801	.165[a]

Hot SBR Latices

FR-S 2000, 2001, 2006	.26[a]
2002	.285[a]
2003, 2004	[illegible]
Naugatex 2000, 2001, 2006	.263[a]
2002	.288[a]
2005	.30[a]
S-2000	.2275[a]
2006	.215[a]

Cold SBR Latices

FR-S 2105	.31[a]
Copo 2101	.28[c]
2102, 2105	.31[c]
X-765	.29[c]
Naugatex 2101	.285[a]
2105	.312[a]
X-767	.323[a]
Pliolite Latex 2101, X765	.30[c]
2105	.32[c]
S-2101	.225[a]

Cold BR Latex§

Pliolite Latex 2104	.32[c]

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Financial

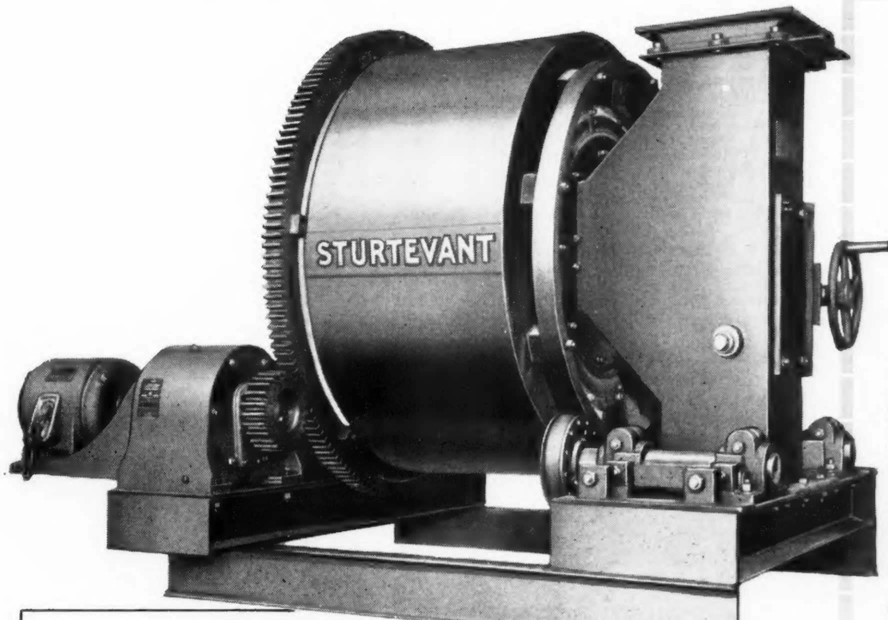
(*Continued from page 904*)

Thiokol Chemical Corp., Trenton, N. J. January 1-June 30, 1956: net income, $386,516, equal to 85¢ a share against $269,028, or 75¢ a share, a year earlier.

Timken Roller Bearing Co., Canton, O. June half, 1956: net profit, $12,977,150, equal to $5.36 a capital share, compared with $11,306,029, or $4.67 a share, in the corresponding half of 1955.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. January 1-June 30, 1956: net income, $96,330, contrasted with $152,848 for the first half of 1955.

COSTS OF BETTER BLENDS CUT TWO TESTED WAYS



ENGINEERING BLENDING AND OTHER DRY PROCESSES TO SPECIFICATIONS

. . . comes naturally to Sturtevant Engineers. They have a tradition of solving dry-processing problems since 1873. Sturtevant custom-built equipment and plants are well-known for their low-maintenance-cost operation. If your problems include any of the processes listed on the coupon, it will pay you to investigate.

Sturtevant Dry-Batch Blenders:

1. **SPEED UP PRODUCTION WITH 4-WAY MIXING**
2. **SHORTEN SHUT-DOWNS WITH "OPEN-DOOR" DESIGN**

Batches from 500 to 40,000 pounds come out of Sturtevant Dry-Batch Blenders exactly as you want them. They are completely blended regardless of the varying weights, densities or fineness of the different ingredients. And no dust is lost in the process. **Four different vertical and lateral mixing actions** inside the sealed rotating drum achieve thorough blending in minimum time. Single lever control of a single gate speeds up loading and discharging.

"Open-Door" accessibility makes cleaning and maintenance a matter of minutes. This original Sturtevant advantage plus 75-year-tested rugged construction assures more output per machine-year. Check the coupon for more information.

STURTEVANT

Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

STURTEVANT MILL COMPANY, 136 Clayton Street, Boston 22, Mass.

Please send me your bulletin on Dry Blenders ☐

Also bulletins on machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ MICRON-GRINDING ☐ SEPARATING ☐ BLENDING
☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

My dry-process materials are: ____________

Desired capacity is: ____________

Name ____________ Title ____________

Firm ____________

Street ____________

City ____________ Zone ____________ State ____________

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00	/ 165.00
Walnut Shell Grits	ton	50.00	/ 160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.55 /	.56
108	lb.	.90	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.50 /	.52
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator 21	lb.	.89	
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.40 /	.42
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.60 /	.61
Du Pont	lb.	.57 /	.58
DPG (diphenylguanidine)			
Cyanamid	lb.	.50 /	.51
Monsanto	lb.	.48 /	.55
El-Sixty	lb.	.58 /	.65
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
50-D	lb.	.85	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac	lb.	.93 /	.95
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.40 /	.42
Du Pont	lb.	.38 /	.40
Naugatuck	lb.	.40 /	.45
-XXX, Cyanamid	lb.	.51 /	.53
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.50 /	.52
Du Pont	lb.	.48 /	.50
Naugatuck	lb.	.50 /	.55
-W Cyanamid	lb.	.53 /	.55
Merac	lb.	.75 /	1.05
Mertax	lb.	.51 /	.58
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
Morfex	lb.	.65 /	.70
MT	lb.	1.00	
NOBS No. 1	lb.	.72 /	.74
Special	lb.	.77 /	.79
O-X-A-F	lb.	.51 /	.56
Pentex	lb.	1.04	
Flour	lb.	.21	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.51 /	.53
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.72 /	.79
NS	lb.	.78 /	.85
Selenacs	lb.	4.25	
Sharples 52-1, 52-3, 52-9	lb.	1.14	
62-0, 62-9, 57-1, 57-3, 57-9, 67-1, 77-0	lb.	1.04	
66-1	lb.	4.25	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20. /	1.34
Tellurac	lb.	1.21	
Tepidone	lb.	.45	
Tetrone A	lb.	1.91	
Thiofide	lb.	.50 /	.57
S	lb.	.52 /	.59
Thionex	lb.	1.14	
Thiotax	lb.	.40 /	.47
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	$1.00 /	$1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Vulcacure Z-B-X	lb.	2.45	
Zenite	lb.	.48 /	0.50
A	lb.	.49 /	.51
Special	lb.	.49 /	.51
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

Accelerator-Activators, Inorganic

Lime, hydrated	ton	20.21	
Litharge, comml.	lb.	.175 /	.18
Eagle, sublimed	lb.	.18	
National Lead, sublimed	lb.	.18 /	.19
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.19	
National Lead	lb.	.19 /	.20
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.19 /	.20
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.20 /	.2175
National Lead	lb.	.1625/	.1725
Zinc oxide, comml.†	lb.	.145/	.1925

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.62	
Capital 170	lb.	.2175/	.2575
171	lb.	.1325/	.1725
700, 701	lb.	.16 /	.20
705, 710	lb.	.16 /	.20
800	lb.	.12/	.14
801	lb.	.1425/	.1625
802	lb.	.1475/	.1675
803	lb.	.17 /	.19
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1375/	.1775
Groco 30	lb.	.1375/	.1775
35	lb.	.1425/	.1825
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.1063/	.1325
430	lb.	.1613/	.1875
431	lb.	.1838/	.1975
Hystrene S-97	lb.	.1863/	.2125
T-45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lb.	1.50	
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.165 /	.205
Groco 2, 4, 8, 18	lb.	.165 /	.205
Plastone	lb.	.27 /	.30
Polyvac	lb.	1.65	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1463/	.1725
150	lb.	.1738/	.20
Hydrofol 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco	lb.	.125 /	.145
Rufat 75	lb.	.1188/	.145
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1413/	.1675
Groco 53	lb.	.1475/	.1675
Wilmar 253	lb.	.1413/	.1675
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1525/	.1725
Wilmar 254	lb.	.1463/	.1725
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.195
Wilmar 255	lb.	.1688/	.195
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.165 /	.205
434	lb.	.1375/	.1775
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeBest A26	lb.	.18 /	.24
620-32B	lb.	.20 /	.26
716-30	lb.	.18 /	.24
1041-21	lb.	.165 /	.225
1293-22A	lb.	1.90 /	2.00
AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.81 /	.83
CD	lb.	.76 /	.78
Albasan	lb.	.69 /	.73
Allied AA-1144	lb.	$0.23 /	$0.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.52 /	.57
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.55 /	.75
Aranox	lb.	3.25	.54
Betanox Special	lb.	.80 /	.85
B-L-E, -25	lb.	.52 /	.57
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.52 /	.57
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H	lb.	.52 /	.59
Flexamine	lb.	.72 /	.77
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.65
NBC	lb.	1.55	
Neozone A	lb.	.59 /	.61
C	lb.	.83	
D	lb.	.55 /	.57
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Octamine	lb.	.52 /	.57
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Permalux	lb.	2.17	
Polygard	lb.	.52 /	.57
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	.92 /	.99
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.52 /	.59
Santovar A	lb.	1.50 /	1.57
Santowhite Crystals, Powder	lb.	1.60 /	1.67
L	lb.	.52 /	.59
MK	lb.	1.29 /	1.36
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Tenamene 3	lb.	.91 /	1.05
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
Ve vapex 51-250	lb.	.40	
V-G-B	lb.	.70 /	.70
Wing-Stay S	lb.	.52 /	.61
Zenite	lb.	.48 /	.55

Antiozonants

Tenamene 30, 31	lb.	1.36 /	1.38
UOP 88, 288	lb.	1.36 /	1.38

Antiseptics

Copper naphthenate, 6–8%	lb.	.24	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.065 /	.085
Carbonate	lb.	.16	
Blowing Agent CP-975	lb.	.35	
Celogen	lb.	1.95	
50-C	lb.	1.01 /	1.07
Sodium bicarbonate	100 lbs.	2.80 /	3.15
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel	lb.	.90	
ND	lb.	.76	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Hylene M	gal.	3.50 /	3.75
M-50	gal.	1.90 /	2.15
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.07

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.15 /	.195
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Collocarb EPC	lb.	$0.059	$0.099
Continental AA	lb.	.074	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074	.1225
Micronex W-6	lb.	.07	.1225
Spheron #9	lb.	.074	.1225
Texas E	lb.	.074	.1225
Witco #12	lb.	.074	.1225
Wyex EPC	lb.	.07	.11

Hard Processing Channel—HPC

Continental F	lb.	.074	.1225
HX HPC	lb.	.074	.1225
Kosmobile S/Dixiedensed S	lb.	.074	.1225
Micromex Mk. II	lb.	.07	.1225
Witco #6	lb.	.074	.1225

Medium Processing Channel—MPC

Arrow MPC	lb.	.07	.11
Continental A	lb.	.074	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074	.1225
Micronex Standard	lb.	.07	.1225
Spheron #6	lb.	.074	.1225
Texas 109	lb.	.079	.1275
M	lb.	.074	.1225
Witco #1	lb.	.074	.1225

Conductive Furnace—CF

Aromex CF	lb.	.08	.12
Vulcan C	lb.	.105	.15
SC	lb.	.18	.223

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.06	.10
Continex FEF	lb.	.06	.10
Kosmos 50/Dixie 50	lb.	.06	.10
Statex M	lb.	.06	.10
Sterling SO	lb.	.06	.10

Fine Furnace—FF

Statex B	lb.	.065	.105
Sterling 99	lb.	.065	.105

High Abrasion Furnace—HAF

Aromex HAF	lb.	.07	.11
Continex HAF	lb.	.079	.125
Kosmos 60/Dixie 60	lb.	.079	.1175
Philblack O	lb.	.074	.114
Statex R	lb.	.07	.12
Vulcan #3	lb.	.074	.114

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.085	.125
Kosmos 70/Dixie 70	lb.	.10	.145
Philblack I	lb.	.09	.13
Statex 125	lb.	.085	.135
Vulcan 6	lb.	.09	.13

Medium Abrasion Furnace—MAF

Philblack A	lb.	.06	.10

Super Abrasion Furnace—SAF

Philblack E	lb.	.125	.165
Vulcan 9	lb.	.125	.165

General Purpose Furnace—GPF

Arogen GPF	lb.	.05	.09
Sterling V	lb.	.05	.09
V Non-staining	lb.	.05	.09

High Modulus Furnace—HMF

Collocarb HMF	lb.	.045	.085
Continex HMF	lb.	.055	.095
Kosmos 40/Dixie 40	lb.	.055	.095
Modulex HMF	lb.	.0525	.0925
Statex 93	lb.	.0525	.095
930	lb.	.047	.087
Sterling L, LL	lb.	.055	.095

Semi-Reinforcing Furnace—SRF

Collocarb SRF	lb.	.042	.082
Continex SRF	lb.	.045	.085
Essex SRF	lb.	.0475	.0875
Furnex	lb.	.0475	.0875
Gastex	lb.	.0525	.0925
Kosmos 20/Dixie 20	lb.	.045	.085
Pelletex, NS	lb.	.0475	.0875
Sterling NS, S	lb.	.0475	.0875
R	lb.	.0525	.0925

Fine Thermal—FT

P-33	lb.	.0575	
Sterling FT	lb.	.055	

Medium Thermal—MT

Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, comml	lb.	.1325	.135
BK—Lansco	lb.	.1275	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico	lb.	.1425	.145
Lampblack, comml	lb.	.16	.45
Superjet	lb.	.0825	.1175
Permanent Blue	lb.	.80	1.05
Stan-Tone	lb.	.45	1.20
Vansul masterbatch	lb.	.60	.65
Paste	lb.	.14	.15

Blue

Alkali Blue	lb.	$1.12	$2.10
Cyanamid ultramarine	lb.	.29	
Du Pont	lb.	1.77	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80	1.45
Lansco ultramarines	lb.	.25	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80	1.05
Stan-Tone	lb.	1.55	1.60
Vansul masterbatch	lb.	.90	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml	lb.	.1425	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1525	.155
Sienna, burnt, comml	lb.	.0425	.155
Williams	lb.	.115	.1775
Raw, comml	lb.	.045	.1325
Williams	lb.	.08	.1725
Umber, burnt, comml	lb.	.06	.07
Williams	lb.	.0725	.085
Raw, comml	lb.	.0625	.07
Williams	lb.	.07	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan 15, 20	lb.	.2275	.23
Metallic Brown	lb.	.05	.06
Vansul masterbatch	lb.	2.10	2.20

Green

Chrome	lb.	.19	.50
Oxide	lb.	.3925	1.10
Cyanamid	lb.	1.10	
G-4099, -6099	lb.	.425	
GH-9869	lb.	1.05	1.20
9976	lb.	1.15	1.30
Green	lb.	.80	2.40
Du Pont	lb.	1.97	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75	4.60
Vansul masterbatch	lb.	2.00	2.60

Orange

Cyanamid Permatons	lb.	1.35	
Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone	lb.	.70	5.05
Vansul masterbatch	lb.	2.00	2.60

Red

Antimony trisulfide	lb.	.285	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21	3.77
Cadmolith	lb.	1.72	2.20
Cyanamid	lb.	.85	1.60
Du Pont	lb.	1.47	1.80
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml	lb.	.06	.13
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1375	.14
Recco	lb.	.12	
Williams Red	lb.	.13	.1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	.85	6.15
Vansul masterbatch	lb.	.95	3.30
Venetian	lb.	.04	.0675

White

Antimony oxide	lb.	.27	.285
Burgess Iceberg	ton	50.00	80.00
Cryptone BT	lb.	.10	.11
Permolith	lb.	.075	.085
Titanium pigments			
Rayox LW	lb.	.195	.205
R-110	lb.	.215	.225
Ti-Cal	lb.	.075	.0825
Ti-Pure	lb.	.195	.225
Titanox A, AA, A-168	lb.	.21	.22
C-50	lb.	.1225	.1275
RA, -10, -50	lb.	.23	.24
RC	lb.	.0825	.0875
-HT, -HTX	lb.	.08	.085
Unitane	lb.	.245	.275
Zopaque Anatase	lb.	.245	.27
Rutile	lb.	.205	.29
Zinc oxide, comml	lb.	.145	.1825
Azo ZZZ-11, -44, -55	lb.	.145	.165
20% leaded	lb.	.1505	.1705
35% leaded	lb.	.155	.175
50% leaded	lb.	.1588	.1788
Eagle AAA, lead free	lb.	$0.145	$0.155
5% leaded	lb.	.145	.155
35% leaded	lb.	.155	.165
50% leaded	lb.	.159	.169
Florence Green Seal	lb.	.1625	.1725
Red Seal	lb.	.1575	.1675
White Seal	lb.	.1675	.1775
Horsehead XX-4, -78	lb.	.145	.155
Kadox-15, -17, -72, -515	lb.	.145	.155
-25	lb.	.1675	.1775
Lehigh, 35% leaded	lb.	.155	
50% leaded	lb.	.1588	.1788
Protox-166, -167	lb.	.145	.165
St. Joe, lead free	lb.	.122	.152
Zinc sulfide, comml	lb.	.253	.263
Cryptone ZS	lb.	.253	.273

Yellow

Cadmium yellow lithopones	lb.	1.12	1.15
Cadmolith	lb.	1.12	1.20
Cyanamid Hansa Yellow	lb.	2.10	
Du Pont	lb.	1.80	2.15
Filo	lb.	.10	
Iron oxide, comml	lb.	.0525	.1175
Lansco synthetic	lb.	.1075	
Mapico	lb.	.115	.1225
Williams	lb.	.115	.1225
Monsanto Yellow 14	lb	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00	1.55
Vansul masterbatch	lb.	.95	1.95
Williams Ocher	lb.	.0575	.06

Dusting Agents

Diatomaceous silica	ton	32.00	48.00
Extrud-o-Lube, conc	gal.	1.54	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.48	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30	.35
Lubrex	lb.	.25	.30
Mica Concord	lb.	.075	.0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Talc, comml	ton	18.40	38.50
EM	ton	11.00	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00	

Extenders

BRS 700	lb.	.02	.0285
BRT 7	lb.	.03	.031
Cumar Resins	lb.	.065	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29	.36
Brown	lb.	.1425	.268
Neophax	lb.	.157	.268
White	lb.	.144	.285
G. B. Asphaltenes	lb.	.06	.065
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00	40.00
Hard Hydrocarbon	ton	46.50	48.50
Hydrocarbon MR	ton	45.00	55.00
Parmr	ton	21.00	29.00
T-MR Granulated	ton	47.50	50.00
Nuba No. 1, 2	lb.	.0575	.0625
3X	lb.	.0775	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.1835	.2012
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.148	.256
Stan-Shells	ton	35.00	73.00
Sublac Resin PX-5	lb.	.215	.235
Synthetic 100	lb.	.41	
Vistanex	lb.	.35	475

Fillers, Inert

Agrashell flour	ton	50.00	74.00
Barytes, floated, white	ton	41.60	60.10
Off-color, domestic	ton	25.00	
No. 1	ton	41.35	60.10
2	ton	39.35	58.00
Sparmite	ton	75.00	80.00
Blanc fixe	ton	100.00	165.00
Burgess Iceberg	ton	50.00	80.00
Pigment #20	ton	35.00	60.00
#30	ton	37.00	60.00
HC-75	ton	12.00	30.00
-80	ton	14.00	32.00
WP #1	ton	11.00	16.00
Cary #200	ton	30.00	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
A. F. D. Filler	ton	26.50	100.00
Aiken	ton	14.00	
Albacar	ton	50.00	55.00
Aluminum Flake	ton	22.25	60.00
#5	ton	24.50	30.00
Champion	ton	14.00	
Crown	ton	14.00	33.00
Dixie	ton	14.00	
Franklin	ton	13.50	35.25

Clays (*cont'd*)			
GK Soft Clay	ton	$11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Paragon	ton	13.50	$31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00	32.00
Swanee	ton	12.50	
Windsor	ton	14.00	30.00
DC Silica	lb.	1.45	1.65
Diatomaceous silica	ton	32.00	48.00
Flocks			
Cotton, dark	lb.	.095	.135
Dyed	lb.	.55	.60
White	lb.	.13	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.22	2.46
Kalite	ton	50.00	65.00
Lithopone, comml	lb.	.075	.085
Astrolith	lb.	.06⅜	.0675
Eagle	lb.	.0725	.075
Sunolith	lb.	.075	.0825
Mica Concord	lb.	.075	.0825
Millical	ton	38.00	53.00
Mineralite	ton	40.00	60.00
Non-Fer-Al	ton	32.50	47.50
Purecal	ton	56.75	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00	35.00
Silversheen Mica	lb.	.08	.09
StanWhite	ton	10.50	13.10
Super-White Silica	ton	25.00	46.50
Surfex	ton	37.50	52.50
MM	ton	39.50	54.50
Suspenso	ton	35.50	50.50
Ti-Cal	lb.	.0675	
Valron estersil	lb.	2.00	2.25
Walnut shell flours	ton	40.00	80.00
Whiting, limestone			
Atomite	ton	30.00	
Calcite	ton	23.00	
Keystone	ton	16.00	
Laminar	ton	30.00	
Omya	ton	30.00	
Paxinosa	ton	11.00	19.00
Snowflake	ton	17.00	18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50	8.00
Flocks, Rayon, colored	lb.	.90	1.50
White	lb.	.75	1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00	2.00
Shellacs, Angelo	lb.	.485	.7325
Vac Dry	lb.	.485	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15	.20
Wax, Bees	lb.	.68	.83
Carnauba	lb.	.57	1.13
Monten	lb.	.27	
No. 118, colors	gal.	.86	1.41
Neutral	gal.	.76	1.31
Van Wax	gal.	1.45	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06	.075
FA #1	lb.	.065	.08
#2	lb.	.075	.09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00	1.15
-144	lb.	.15	.30
-307	lb.	1.10	1.25
-311	lb.	.60	.75
Aerosol, dry types	lb.	.39	1.20
Liquid types	lb.	.40	.72
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Alrosol	lb.	.41	
Alrowet D-75	lb.	.63	
Amberex solutions	lb.	.1675	.18
Antifoam J-114	lb.	3.25	3.45
P-242	lb.	.24	.35
Antioxidant J-137, -140	lb.	.55	.70
-139, -293	lb.	1.45	1.60
-182	lb.	2.00	2.15
-186	lb.	1.40	1.55
2246	lb.	1.50	1.53
Anti Webbing Agent J-183	lb.	.75	.90
-297	lb.	.27	.40
Aquablak B	lb.	.0975	.1025
G	lb.	.12	.125
K	lb.	.12	.125
M	lb.	.105	.11
Aquarex D	lb.	.78	
G	lb.	.21	
L, ME	lb.	.94	
MDL	lb.	.33	
NS	lb.	.60	
SMO	lb.	.50	
Areskap 50	lb.	.30	.38
100, dry	lb.	.60	.72
Aresket 240	lb.	.30	.38
300, dry	lb.	.60	.72
Aresklene 375	lb.	$0.42	$0.57
Ben-A-Gels	lb.	.98	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -40, -300	lb.	1.00	1.17
CW-12	lb.	.85	
37	lb.	.70	
DC Antifoam A Compound	lb.	5.45	6.65
Emulsion	lb.	2.05	4.00
AF Emulsion	lb.	2.05	2.85
Compound 7	lb.	5.13	6.50
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525	.26
N	lb.	.155	.26
Darvan Nos. 1, 2, 3	lb.	.22	.30
Daxad 11, 21, 23, 27	lb.	.08	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Empulphor ON-870	lb.	.50	.70
Igepal CO-630	lb.	.2875	.47
Igepon T-73	lb.	.285	.495
T-77	lb.	.45	.69
Indulins	lb.	.06	.08
Kreelons	lb.	.132	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225	.1425
N	lb.	.095	.105
Modicols	lb.	.17	.58
Nekal BA-75	lb.	.395	.54
BX-76	lb.	.63	.75
Pluronics	lb.	.335	.40
Polyfons	lb.	.08	.09
Sorapon SF-78	lb.	.28	.40
Tergitol NPX	lb.	.275	.3074
TMN	lb.	.2875	.32
7	lb.	.4125	.44
Trenamine	lb.	.15	
Triton R-100	lb.	.12	.25
X-100, -102, -114	lb.	.255	.36
Dispersions			
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Black No. 25	lb.	.22	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30	.35
P-33	lb.	.35	
Rayox	lb.	.45	
Rotax	lb.	.75	
Sulfur	lb.	.12	.30
No. 2	lb.	.14	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcanizing, C group	lb.	.40	1.30
G group	lb.	.45	.90
N group	lb.	.40	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Habuco Resin Nos. 502, 515, 523	lb.	.195	.20
503	lb.	.22	.225
504, 526	lb.	.19	.195
517	lb.	.175	.18
524	lb.	.155	.16
Resin A-2	lb.	.16	.25
P-370	lb.	.175	.25
X-210	lb.	.12	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Gelling Agent P-397	lb.	.34	
Igepon T-43	lb.	.145	.35
T-51	lb.	.125	.285
-73	lb.	.285	.495
Indulins	lb.	.06	.08
Ludox	lb.	.1675	.195
Marmix	lb.	.41	.48
Merac	lb.	.75	1.05
Micronex, colloidal	lb.	.06	.072
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD-101	lb.	.16	.26
Pliolite Latex 150, 190	lb.	.32	.41
170	lb.	.37	.46
Polyvinyl methyl ether	lb.	.25	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44	.65
S	lb.	.13	.25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905	.975
30A	lb.	.245	.265
ST	lb.	.585	.615
Setsit #5	lb.	.75	1.05
Stablex A	lb.	.80	1.10
B, G	lb.	.50	.95
K	lb.	.27	.35
P	lb.	.35	.50
T	lb.	.14	.22
Surfactol 13	lb.	.345	.36
Webnix	lb.	1.50	2.50

Mold Lubricants

Acintol D	lb.	$0.06	$0.075
A-C Polyethylene	lb.	.30	.37
Alipal CO-433	lb.	.25	.45
CO-436	lb.	.22	.41
Aquarex Compounds	lb.	.21	.94
Carbowax 200, 300, 400	lb.	.22	.25
1500	lb.	.255	.2825
4000	lb.	.31	.32
6000	lb.	.35	.36
Castorwax	lb.	.21	.27
Colite Concentrate	gal.	.90	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14	4.75
Compound 4, 7	lb.	5.13	6.50
Emulsion 7	lb.	1.59	2.07
8, 35, 35A, 35B, 36	lb.	1.26	1.80
200 Fluid	lb.	3.14	4.75
ELA	lb.	.82	
FT Wax 200	lb.	.265	.42
300	lb.	.295	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.25	1.63
Igepals	lb.	.2875	.74
Igepon AP-78	lb.	.44	.68
T-43	lb.	.145	.35
-51	lb.	.125	.285
-73	lb.	.285	.495
Lubrex	lb.	.25	.30
Lubri-Flo	gal.	10.00	12.05
Lustermold	lb.	.41	
L-41 Diethyl Silicone Oil	lb.	3.50	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
Para Lube	lb.	.046	.048
Plaskon 8406, 8407	lb.	.30	.37
8416, 8417	lb.	.35	.42
8429	lb.	.40	.47
Pluronics	lb.	.335	.44
Polyglycol E series	lb.	.29	.42
Rubber-Glo	gal.	.94	.97
SM-33, -55, -61, -62	lb.	1.22	1.76
Soap, Hawkeye	lb.	1.35	1.45
Purity	lb.	.155	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20	1.25
800 series	gal.	1.26	1.70
900 series	gal.	1.55	2.55
A Series	gal.	1.80	4.50
Ucon 50-HB Series	lb.	.25	.375
Ulco	lb.	.12	.23
Vanfre	gal.	2.50	3.00

Odorants

Alamasks	lb.	.75	6.50
Coumarin	lb.	2.95	3.55
Curodex 19	lb.	4.75	5.05
188	lb.	5.75	
198	lb.	6.75	
Ethavan	lb.	6.75	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00	3.15

Plasticizers and Softeners

Acintol R	lb.	.065	.07
Adipol 2EH, 10A	lb.	.40	.435
BCA	lb.	.43	.455
ODY	lb.	.45	.485
Admex 710	lb.	.325	
711	lb.	.345	
744	lb.	.40	
Aro Lene #1980	lb.	.10	.12
Baker AA Oil	lb.	.195	.24
Crystal O Oil	lb.	.21	.255
Processed oils	lb.	.215	.235
Bardol, 639	lb.	.215	.235
B	lb.	.0625	.065
Benzoflex 2-45	lb.	.26	.29
9-88	lb.	.27	.30
Bondogen	lb.	.55	.60
BRC 20	lb.	.15	.175
22	lb.	.025	.0275
30	lb.	.0125	.021
521	lb.	.019	.02
BRH 2	lb.	.0213	.0351
BRS 700	lb.	.02	.0285
BRT 7	lb.	.03	.031
BRV	lb.	.0475	.0565
Bunarex Liquid	lb.	.0425	.0555
Resins	lb.	.065	.1225
Bunnatol G, S	lb.	.40	.505
Butac	lb.	.125	.135
Butyl stearate, comml	lb.	.255	
Binney & Smith	lb.	.23	.26
Hardesty	lb.	.23	.26
Ohio-Apex	lb.	.22	.255
BxDC	lb.	.40	.41
Cabflex HS-10	lb.	.44	.47
Califlux 510, 550	lb.	.025	.0325
G. P.	lb.	.0125	.02
R-100	lb.	.045	.0525
TT	lb.	.017	.0245
Capryl alcohol, comml	lb.	.195	.235
Binney & Smith	lb.	.18	.28
Hardesty	lb.	.18	.28
Chlorowax 40	lb.	.1625	.1825
70	lb.	.185	.245
-S	lb.	.21	.27
Contogums	lb.	.0875	.111
Cumar Resins	lb.	.065	.17
DBM (dibutyl-m-cresol) Darex	lb.	.32	.3475
DBP (dibutyl phthalate), comml	lb.	.30	.33

DPB (*Cont'd*)		
Darex . . . . . lb.	$0.30 /	$0.33
Eastman . . . . . lb.	.30 /	.33
Hatco . . . . . lb.	.30 /	.33
Monsanto . . . . . lb.	.30 /	.33
Naugatuck . . . . . lb.	.30 /	.33
Ohio-Apex . . . . . lb.	.30 /	.335
PX-104 . . . . . lb.	.30 /	.33
Rubber Corp. of America . lb.	.30 /	.44
Sherwin-Williams . . . . . lb.	.30 /	.33
DBS (dibutylsebacate), comml . . . . . lb.	.66 /	.69
Hatco . . . . . lb.	.66 /	.685
Monoplex . . . . . lb.	.66 /	.675
Naugatuck . . . . . lb.	.665 /	.69
PX-404 . . . . . lb.	.665 /	.69
DPC (dicaprylphthalate), comml . . . . . lb.	.295 /	.325
Hatco . . . . . lb.	.295 /	.325
Monoplex . . . . . lb.	.30 /	.315
DDA (didecyladipate)		
Cabflex . . . . . lb.	.425 /	.455
Good-rite GP-236 . . . . . lb.	.40 /	.55
DDP (didecylphthalate)		
Cabflex . . . . . lb.	.305 /	.335
Good-rite GP-266 . . . . . lb.	.305 /	.455
Hatco . . . . . lb.	.305 /	.435
Defoamer X-3 . . . . . lb.	.355	
DIBA (diisobutyladipate)		
Cabflex . . . . . lb.	.4325/	.4625
Darex . . . . . lb.	.4325/	.4625
Eastman . . . . . lb.	.41 /	.44
Ohio-Apex . . . . . lb.	.41 /	.445
DIDA (diisodecyladipate)		
Monsanto . . . . . lb.	.425 /	.455
DIDP (diisodecylphthalate)		
Darex . . . . . lb.	.32 /	.35
Monsanto . . . . . lb.	.305 /	.335
Ohio-Apex . . . . . lb.	.305 /	.34
PX-120 . . . . . lb.	.305 /	.335
Dielex B . . . . . lb.	.06	
Diethylene glycol, comml . . lb.	.1525/	.1825
Wyandotte . . . . . lb.	.15 /	.165
Dinopol IDO . . . . . lb.	.305 /	.34
DIOA (diisooctyladipate)		
Cabflex . . . . . lb.	.425 /	.455
Naugatuck . . . . . lb.	.435 /	.465
PX-208 . . . . . lb.	.425 /	.455
Rubber Corp. of America . lb.	.425 /	.56
DIOP (diisooctylphthalate), comml . . . . . lb.	.305 /	.335
Cabflex . . . . . lb.	.305 /	.335
Darex . . . . . lb.	.32 /	.35
Eastman . . . . . lb.	.305 /	.335
Hatco . . . . . lb.	.305 /	.335
Monsanto . . . . . lb.	.305 /	.335
Naugatuck . . . . . lb.	.305 /	.335
Ohio-Apex . . . . . lb.	.305 /	.34
PX-108 . . . . . lb.	.305 /	.335
Rubber Corp. of America . lb.	.305 /	.45
Sherwin-Williams . . . . . lb.	.32 /	.34
DIOS (diisooctylsebacate), comml . . . . . lb.	.61 /	.64
Rubber Corp. of America . lb.	.61 /	.84
DIOZ (diisooctylazelate)		
Cabflex . . . . . lb.	.48 /	.51
D polymer Oil . . . . . gal.	.33 /	.38
D spersing Oil No. 10 . . . . . lb.	.06 /	.0625
DNODP (di-n-octyl-n-decyl phthalate), Monsanto . . . . lb.	.345 /	.375
DOA (dioctyladipate), comml . . . . . lb.	.425 /	.455
Cabflex . . . . . lb.	.425 /	.455
Eastman . . . . . lb.	.40 /	.43
Good-rite GP-233 . . . . . lb.	.40 /	.55
Hatco . . . . . lb.	.435 /	.465
Monsanto . . . . . lb.	.425 /	.455
Naugatuck . . . . . lb.	.435 /	.465
PX-238 . . . . . lb.	.425 /	.455
Rubber Corp. of America . lb.	.425 /	.56
DOP (dioctylphthalate), comml . . . . . lb.	.305 /	.335
Cabflex . . . . . lb.	.305 /	.335
Darex . . . . . lb.	.32 /	.35
Eastman . . . . . lb.	.305 /	.335
Good-rite GP-261 . . . . . lb.	.305 /	.455
Hatco . . . . . lb.	.305 /	.335
Monsanto . . . . . lb.	.305 /	.335
Naugatuck . . . . . lb.	.305 /	.335
Ohio-Apex . . . . . lb.	.305 /	.34
PX-138 . . . . . lb.	.305 /	.335
Rubber Corp. of America . lb.	.305 /	.45
Sherwin-Williams . . . . . lb.	.32 /	.34
DOS (dioctylsebacate), comml . . . . . lb.	.61 /	.64
Eastman . . . . . lb.	.61 /	.64
Hatco . . . . . lb.	.61 /	.635
Monoplex . . . . . lb.	.61 /	.635
Naugatuck . . . . . lb.	.615 /	.64
PX-438 . . . . . lb.	.615 /	.64
Rubber Corp. of America . lb.	.61 /	.84
Drapex 3.2 . . . . . lb.	.40 /	.45
Dutch Boy NL-A10 (DBP) . . lb.	.30 /	.33
-A20 (DOP), A30 (DIOP) . lb.	.305 /	.335
-A54 . . . . . lb.	.295 /	.325
-C20 (DOS) . . . . . lb.	.61 /	.63
-F21 . . . . . lb.	.395 /	.425
-F31 . . . . . lb.	.44 /	.47
-F41 . . . . . lb.	.48 /	.51
Dutrex 6 . . . . . lb.	025 /	.035
Emulphor EL-719 . . . . . lb.	.52 /	.73
Ethox . . . . . lb.	.43 /	.455
Ethylene glycol, comml . . . . lb.	.135 /	.165
Wyandotte . . . . . lb.	.1325/	.1425
Flexol 3 GH . . . . . lb.	.44 /	.46
3 GO . . . . . lb.	.53 /	.55
4 GO . . . . . lb.	.325 /	.355
10-A . . . . . lb.	.425 /	.455

Flexol 426 . . . . . lb.	$0 27 /	$0.30
810, 810X, 10-10, 10-10X . lb.	.305 /	.335
TOF, A-26 . . . . . lb.	.435 /	.465
Flexricin P-1 . . . . . lb.	.295 /	.31
Flexricin P-4 . . . . . lb.	.285 /	.31
P-8 . . . . . lb.	.305 /	.32
PG-16 . . . . . lb.	.335 /	.35
Fortex . . . . . lb.	.125 /	.145
G. B. Asphaltic Flux . . . . . gal.	.08 /	.14
Naphthenic Neutrals . . . . gal.	.11 /	.18
Process oil, light . . . . . lb.	.025 /	.0325
Medium . . . . . lb.	.035 /	.0425
Galex W-100 . . . . . lb.	.155 /	.18
W-100 D . . . . . lb.	.1525/	.1775
Gilsowax B . . . . . lb.	.0975/	.11
Harchemex . . . . . lb.	.25 /	.34
Harflex 10 . . . . . lb.	1.25 /	1.335
40 . . . . . lb.	.64 /	.725
50, 80, 300 . . . . . lb.	.58 /	.665
60 . . . . . lb.	.62 /	.705
90 . . . . . lb.	.88 /	.965
120, 150 . . . . . lb.	.305 /	.395
140, 160 . . . . . lb.	.30 /	.33
180 . . . . . lb.	.295 /	.38
220, 250 . . . . . lb.	.425 /	.515
260 . . . . . lb.	.42 /	.45
280 . . . . . lb.	.42 /	.51
500 . . . . . lb.	.315 /	.41
HB-20 . . . . . lb.	.15 /	.17
-40 . . . . . lb.	.19 /	.21
Heavy Resin Oil . . . . . lb.	.0225/	.0375
HSC-13 . . . . . lb.	.27 /	.30
Indonex . . . . . gal.	.11 /	.19
Kapsol . . . . . lb.	.3225/	.3525
Kenflex A, L . . . . . lb.	.26 /	.27
B . . . . . lb.	.23 /	.24
N . . . . . lb.	.18 /	.19
Kessoflex 103 . . . . . lb.	.405	
105 . . . . . lb.	.3325	
106 . . . . . lb.	.38	
107 . . . . . lb.	.525	
110 . . . . . lb.	.24	
111 . . . . . lb.	.28	
KP-23 . . . . . lb.	.29 /	.325
-90 . . . . . lb.	.40 /	.435
-140 . . . . . lb.	.46 /	.485
-201 . . . . . lb.	.5825/	.5925
-220 . . . . . lb.	.31 /	.345
-555 . . . . . lb.	.46 /	.485
Kronisol . . . . . lb.	.33 /	.365
Kronitex AA, I, K-3, Mx . . lb.	.345 /	.38
LX-685, -125, -135, ... lb.	.125 /	.135
Marvinol plasticizers . . . . . lb.	.28 /	.8825
Methox . . . . . lb.	.385 /	.41
Monoplex S-38 . . . . . lb.	.215 /	.24
S-71 . . . . . lb.	.45 /	.475
Morflex . . . . . lb.	.25 /	.65
Natac . . . . . lb.	.12 /	.13
Neoprene Peptizer P.-12 . . . . lb.	1.05	
Nevillac . . . . . lb.	.31 /	.85
Neville R Resins . . . . . lb.	.145 /	.205
Nevinol . . . . . lb.	.24	
No. 1-D heavy oil . . . . . lb.	.065	
ODA (octyldecyladipate)		
Cabflex . . . . . lb.	.425 /	.455
Good-rite GP-235 . . . . . lb.	.40 /	.55
ODP (octyldecylphthalate)		
Cabflex . . . . . lb.	.305 /	.335
Good-rite GP-265 . . . . . lb.	.305 /	.455
Hatco . . . . . lb.	.305 /	.335
Rubber Corp. of America . lb.	.305 /	.45
Ohopex R-9 . . . . . lb.	.3525/	.3775
Q-10 . . . . . lb.	.295 /	.33
Orthonitro benzophenol, comml . . . . . lb.	.13 /	.15
Monsanto . . . . . lb.	.13 /	.15
Palmalene . . . . . lb.	.15	
Panaflex BN-1 . . . . . lb.	.185 /	.225
Para Flux, regular . . . . . gal.	.10 /	.2125
No. 2016 . . . . . gal.	.165 /	.24
2332 . . . . . gal.	.11	
4205 . . . . . lb.	.1075/	.2125
Para Lube . . . . . lb.	.046 /	.048
Resins . . . . . lb.	.04 /	.045
Paradene Resins . . . . . lb.	.07 /	.08
Paraplex 5-B . . . . . lb.	.29 /	.3475
AL-111 . . . . . lb.	.32 /	.3275
G-25 . . . . . lb.	.76 /	.77
-40 . . . . . lb.	.4825/	.51
-50 . . . . . lb.	.39 /	.4175
-53 . . . . . lb.	.4325/	.46
-60 . . . . . lb.	.325 /	.35
-62 . . . . . lb.	.345 /	.37
RG-7 . . . . . lb.	.33 /	.335
-8 . . . . . lb.	.505 /	.5125
-10 . . . . . lb.	.52 /	.5275
Pepton 22 . . . . . lb.	.79 /	.82
Philrich 5 . . . . . gal.	.11	
Picco Resins . . . . . lb.	.135 /	.195
480 Oilproof Series . . . . . lb.	.18 /	.23
Aromatic Plasticizers . . . . . lb.	.05 /	.065
Liquid Resin D-165 (Y) . . lb.	.06 /	.075
(Z-3) . . . . . lb.	.07 /	.085
(Z-6) . . . . . lb.	.08 /	.095
S. O. S. . . . . . gal.	.29 /	.34
Piccocizers . . . . . lb.	.04 /	.055
Piccolastic Resins . . . . . lb.	.1855/	.34
Piccolyte Resins . . . . . lb.	.185 /	.25
Piccopale Resins . . . . . lb.	.12 /	.135
Piccovars . . . . . lb.	.165 /	.20
Piccovol . . . . . lb.	.025 /	.038
Pictar . . . . . gal.	.25 /	.30
Pigmentar . . . . . lb.	.046 /	.0745
Pigmentaroil . . . . . lb.	.046 /	.0745
Pine Tar, Sunny South . . . . . lb.	.046 /	.0801
Oil, Sunny South . . . . . lb.	.046 /	.0801
Pitch, Burgundy, Sunny South . . . . . lb.	.1030/	.1085

Plasticizers		
42 . . . . . lb.	$0.34 /	$0.40
B . . . . . lb.	.35 /	.45
DP-520 . . . . . lb.	.435 /	.455
MP . . . . . lb.	.035 /	.0755
MT-511 . . . . . lb.	.535 /	.565
ODN . . . . . lb.	.32 /	.37
SC . . . . . lb.	.54 /	.63
Plastoflex #3 . . . . . lb.	.52 /	.57
#520 . . . . . lb.	.36 /	.435
DBE . . . . . lb.	.50 /	.55
MGB . . . . . lb.	.29 /	.37
SP-2 . . . . . lb.	.43 /	.48
VS . . . . . lb.	.3575/	.3975
Plastogen . . . . . lb.	.0775/	.08
Plastone . . . . . lb.	.22 /	.3075
Polycin 470 . . . . . lb.	.275 /	.29
Polycizers . . . . . lb.	.305 /	.55
Polymel D . . . . . lb.	.225 /	.235
C-128 . . . . . lb.	.1775/	.1875
D-TAC . . . . . lb.	.1975/	.215
DX, C-130 . . . . . lb.	.1375/	.1475
PT67 Light Pine Oil . . . . . gal.	.60	
101 Pine Tar Oil . . . . . lb.	.046 /	.0634
Pine Tars . . . . . lb.	.046 /	.0634
Reogen . . . . . lb.	.1325/	.135
Resin C pitch . . . . . lb.	.0225/	.031
R6-3 . . . . . lb.	.38 /	.40
Resinex 10, 25, 50, 110 . . . . lb.	.04 /	.045
70 . . . . . lb.	.0325/	.0375
85, 100 . . . . . lb.	.035 /	.04
115 . . . . . lb.	.0375/	.0425
L-2, L-3, L-4, L-5 . . . . . lb.	.0225/	.03
Rosin Oil, Sunny South . . . . gal.	.58 /	.875
RPA No. 2 . . . . . lb.	.78	
3 . . . . . lb.	.47	
Conc . . . . . lb.	.97	
5 . . . . . lb.	.59	
RSN Flux . . . . . gal.	.10 /	.19
Rubber Oil B-5 . . . . . lb.	.0225/	.0355
Rubberol . . . . . lb.	.18 /	.2725
Santicizer 1-H . . . . . lb.	.50 /	.51
3 . . . . . lb.	.46 /	.47
8 . . . . . lb.	.43 /	.44
9 . . . . . lb.	.39 /	.42
140 . . . . . lb.	.33 /	.36
Santicizer-141 . . . . . lb.	.34 /	.37
160 . . . . . lb.	.25 /	.28
601 . . . . . lb.	.325	
602 . . . . . lb.	.305	
B-16 . . . . . lb.	.4875/	.4975
E-15 . . . . . lb.	.5075/	.5375
M-17 . . . . . lb.	.4275/	.4575
Sebacic acid, purified, comml . . . . . lb.	.59 /	65
Binney & Smith . . . . . lb.	.64 /	.76
Hardesty . . . . . lb.	.64 /	.76
C.P.-Binney & Smith . . . . lb.	.72 /	.84
Hardesty . . . . . lb.	.72 /	.84
Sherolatum Petrolatum . . . . . lb.	.05 /	.10
Softener #20 . . . . . gal.	.10 /	.20
Special Rubber Resin 100 . . . lb.	.1675/	.2175
Staflex AX . . . . . lb.	.43	
DBES . . . . . lb.	.61 /	.635
Syn-Tac . . . . . gal.	.33 /	35
Sunthol . . . . . lb.	.17 /	.2625
Thiokol TP-90B . . . . . lb.	.59	
-95 . . . . . lb.	.65	
Tricresyl phosphate, comml . . lb.	.33 /	.36
Cabflex . . . . . lb.	.345 /	.375
Monsanto . . . . . lb.	.33 /	.36
Naugatuck . . . . . lb.	.33 /	.36
PX-917 . . . . . lb.	.33 /	.36
Triphenyl phosphate, comml . . . . . lb.	.39 /	.40
Monsanto . . . . . lb.	.39 /	.40
Turgum S . . . . . lb.	.1075/	.1175
Tysonite . . . . . lb.	.24 /	.2475
United . . . . . gal.	.69 /	1.20
X-1 Resinous Oil . . . . . lb.	.0225/	.0325

Reclaiming Oils

Acintol C, P . . . . . lb.	.02 /	.03
Bardol, 639 . . . . . lb.	.0275/	.0375
B . . . . . lb.	.0625/	.065
BRH 2 . . . . . lb.	.0213/	.0351
BRT 3 . . . . . lb.	.018 /	.0265
4 . . . . . lb.	.025 /	.026
7 . . . . . lb.	.03 /	.031
BRV . . . . . lb.	.0475/	.0565
Burco-RA . . . . . lb.	.053 /	.0805
BWH-1 . . . . . lb.	.16 /	.18
Dipolymer Oil . . . . . gal.	.33 /	.43
Dispersing Oil No. 10 . . . . . lb.	.06 /	.0625
G. B. Oils . . . . . gal.	.10 /	.24
Heavy Resin Oil . . . . . lb.	.0225/	.0375
LX-572 . . . . . gal.	.27 /	.32
-759 . . . . . gal.	.1375	
-777, -809, -859 . . . . . gal.	.23 /	.33
-869 . . . . . gal.	.33 /	.43
-871 . . . . . gal.	.34 /	.44
No. 3186 . . . . . gal.	.28 /	.295
Picco 6535 . . . . . gal.	.25 /	.30
C-33 . . . . . gal.	.215 /	.315
-42 . . . . . gal.	.23 /	.33
D-4 . . . . . gal.	.27 /	.37
E-5 . . . . . gal.	.25 /	.35
Q-Oil . . . . . gal.	.286 /	.36
PT 67 . . . . . gal.	.60	
101 Pine Tar Oil . . . . . lb.	.0427/	.0610
150 Pine Solvent . . . . . gal.	.44	
Reclaiming Oil #3186 . . . . . gal.	.28 /	.385
-G . . . . . gal.	.25 /	.365
4039-M . . . . . gal.	.3275/	.3975
-Y . . . . . gal.	.30 /	.37
RR-10 . . . . . lb.	.36	
S. R. O. . . . . . lb.	.015 /	.0225
X-1 Resinous Oil . . . . . lb.	.0225/	.0325

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

GENERAL RATES

Light face type $1.25 per line (ten words)
Bold face type $1.60 per line (eight words)
Allow nine words for keyed address.

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS WANTED RATES

Light face type 40c per line (ten words)
Bold face type 55c per line (eight words)

SITUATIONS OPEN RATES

Light face type $1.00 per line (ten words)
Bold face type $1.40 per line (eight words)

Letter replies forwarded without charge, but no packages or samples.

SITUATIONS OPEN

VINYL CHEMIST
Experienced in compounding and coating plastisols and organosols. Excellent opportunity in New England area. Give complete résumé and salary expected. All replies will be strictly confidential. Address Box No. 1962, care of RUBBER WORLD.

TECHNICAL SALES REPRESENTATIVE
Must have sales experience and good technical background in adhesives for rubber bonding. To travel in northeastern United States. Good opportunity with progressive, expanding company. Address Box No. 1963, care of RUBBER WORLD.

IN SOUTH CAROLINA
Rubber Chemist to head new development group, director level. Ph.D. preferred, but not required. A real opportunity in an expanding company. CONTINENTAL TAPES, Cayce, S. C.

TILING ENGINEER
WANTED
Vinyl Asbestos or Vinyl
Excellent opportunity for man having at least two or three years' experience. Liberal Pension & Hospitalization program. Location Midwest. Address Box No. 1964, care of RUBBER WORLD.

FLOOR TILE CHEMIST
WANTED
Experienced manufacturer vinyl tile. Insurance, Hospitalization, and retirement. Replies treated confidentially. Address Box No. 1965, care of RUBBER WORLD.

PLASTISOL CHEMIST—UNUSUAL LIFETIME OPPORTUNITY for man with wide lab and field experience in vinyl plastisols and organisols. Desire man with qualifications leading to management of this fast-growing division of our company. Replies strictly confidential. Salary open—with bonus or stock option. FEDERAL CHEMICALS CORP., 210 Wythe Ave., Brooklyn 11, N. Y.

ELECTRICAL INSULATING AND SPECIALTY TAPE CHEMIST
Excellent opportunity for chemist with experience in Rubber and Plastic Electrical and Specialty Tapes. Address replies in detail to: Frank Harris, Vice President, Plymouth Rubber Company, Inc., Canton, Mass.

FACTORY MANAGER—Thoroughly experienced for plant employing 100 on miscellaneous molded, extruded, and lathe-cut goods. Excellent opportunity in plant in fine resort area, 40 miles from New York City. Address Box No. 1968, care of RUBBER WORLD.

CHEMIST—Practical compounder for plant employing 100 on miscellaneous molded, extruded, and lathe-cut goods. Excellent opportunity in plant in fine resort area 40 miles from New York City. Address Box No. 1969, care of RUBBER WORLD.

RUBBER CHEMIST, B.S. DEGREE, COMPOUND DEVELOPMENT work dealing directly with production in small, progressive company in southwestern U. S. Opportunity for advancement. Give complete résumé and salary expected. Address Box No. 1970, care of RUBBER WORLD.

CHEMICAL ENGINEERS
MECHANICAL ENGINEERS
CHEMISTS

EXPERIENCED IN RUBBER COMPOUNDING.

Expanding Sales force of a nationally prominent Eastern producer of rubber chemicals and synthetic rubber offers a challenging opportunity as a

TECHNICAL SALES REPRESENTATIVE.

Age to 35. Excellent fringe benefit programs. Furnish complete details of experience, military status, education, and salary requirements. All replies confidential.

ADDRESS BOX NO. 1960, c/o RUBBER WORLD

SITUATIONS OPEN (Continued)

WANTED:

TECHNICAL DIRECTOR'S ASSISTANT

Excellent opportunity for advancement with medium-sized Midwestern firm manufacturing mechanical goods and coated fabrics mainly for the Graphic Arts Industry. Require an energetic man with initiative for method improvements and cost reduction. Experience in this line is desirable. Must also have some experience in labor relations. Write giving age, experience, and education in first letter. Replies held in strict confidence.

ADDRESS BOX NO. 1961, c/o RUBBER WORLD

RUBBER RESEARCH CHEMIST WITH B.S. OR M.S. DEGREE required to carry out research on new types of elastomers being developed on a fundamental research project. Experience in rubber compounding and testing is desirable. Apply: HOOKER ELECTROCHEMICAL COMPANY, Industrial Relations Dept., Niagara Falls, New York.

PLANT ENGINEER
Thoroughly experienced in installation and maintenance of rubber Banburys, Mills, Hydraulic Presses, Extruders, etc. Must have ability to efficiently direct maintenance crews. So. Calif. location. Address Box No. 1966, care of RUBBER WORLD.

PROCESS OR TOOLING ENGINEER for precision molded rubber products. Processing experience in fields of extrusion, molding, finishing, or experience in mold or small-tool design and methods. Work for prominent Midwest manufacturing organization. Salaries commensurate with experience and ability. Many other company benefits. All replies kept strictly confidential. Address Box No. 1967, care of RUBBER WORLD.

SUPERVISORS—Openings for press-room foreman in plant employing 100 on miscellaneous molded, extruded, and lathe-cut goods. Excellent opportunity in plant in fine resort area 40 miles from New York City. Address Box No. 1979, care of RUBBER WORLD.

AKRON-CLEVELAND AREA
Well-known manufacturers' agents serving rubber and paint trade with raw materials in Ohio area. Excellent facilities with liquid storage, drumming, and general warehousing. Additional capacity available. Address Box No. 1981, care of RUBBER WORLD.

SITUATIONS WANTED

EXPERIENCED RUBBER CHEMIST AND DEVELOPMENT engineer desires change with opportunity for advancement. Address Box No. 1971, care of RUBBER WORLD.

ASSISTANT SUPT., 21 YEARS' EXPERIENCE IN THE PROduction of latex-dipped goods. Specializing in gloves, finger cots, tubing, and balloons, desires permanent position with established rubber company. Minimum salary $600. Address Box No. 1972, care of RUBBER WORLD.

TRADER OR SALES REPRESENTATIVE
Twenty years' experience crude, reclaim, scrap rubber, also vinyl, polyethylene and other thermoplastics. Seek position in London, England, area. U. S. citizen, British ancestry. Address Box No. 1973, care of RUBBER WORLD.

PRODUCT DEVELOPMENT—Chemical consulting laboratory has increased their facilities for developing new products and assistance with customer production problems. We specialize in Latex, Polyvinyl Acetate, and Acrylic resin emulsion (water-base) paints, plus latex and resin adhesives. Your inquiries are invited. Address Box No. 1974, care of RUBBER WORLD.

Reinforcers, Other Than Carbon Black

American Resinous Chemical			
978-42B	lb.	$0 18	$0.19
1073-18B	lb.	.135	.145
1294-36B	lb.	115	.125
1301-12B	lb.	15	.16
Angelo Shellacs	lb.	.485	.7325
BRC 20	lb.	.15	.175
22	lb.	.025	.0275
30	lb.	.0125	.021
521	lb.	.019	.02
Bunarex Resins	lb.	.065	.1225
Cab-o-sil	lb.	.68	.75
Calcene NC	ton	72.50	92.50
TM	ton	75.00	95.00
Calco S. A.	lb.	.85	.88
Clays			
Aiken	ton	14.00	
Aluminum Flake	ton	22.25	60.00
Buca	ton	45.00	
Burgess Iceberg	ton	50.00	80.00
Icecap K	ton	65.00	90.00
Pigment No. 20	ton	35.00	60.00
30	ton	37.00	60 00
Catalpo	ton	35.00	
Crown	ton	14.00	33.00
Dixie	ton	14.00	
Franklin	ton	13.50	35.25
L. G. B.	ton	17.00	
Paragon	ton	13.50	33.00
Pigment No. 33	ton	37.00	
Recco	ton	14.00	
Suprex	ton	14.00	33.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00	30.00
Witco No. 1	ton	14.00	30.00
No. 2	ton	13.50	30.00
Clearcarb	lb.	.1175	.1255
Cumar Resins	lb.	.065	.17
Darex Resins	lb.	.42	.49
DC Silica	lb.	1.45	1.65
Diatomaceous silica	ton	32.00	48.00
Good-rite Resin 50	lb.	.39	.41
K Series Polymers	lb.	.15	.37
Hi-Sil 101	lb.	.11	.125
233	lb.	.09	.105
X303	lb.	.40	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06	.08
Kralac A-EP	lb.	.43	.54
Laminar	ton	30.00	
Magnesium carbonate, Merck	lb.	.105	.12
Marbon Resins	lb.	.39	.46
Multifex MM	ton	110.00	125.00
Super	ton	160.00	175.00
Neville Resins			
465	lb.	.075	.08
LX-509	lb.	.33	.35
Nebony	lb.	.045	.05
Paradene	lb.	.07	.08
R	lb.	.145	.205
Para Resins 2457, 2718	lb.	.04	.4575
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.13	.185
Piccolyte Resins	lb.	.205	.275
Piccoumaron Resins	lb.	.07	.19
Piccovars	lb.	.145	.20
Pliolite NR types	lb.	.98	1.33
S-3, -6	lb.	.42	.49
-6B	lb.	.39	.46
Purecal M	ton	56.75	71.75
SC, T	ton	110.00	125.00
U	ton	120.00	135.00
R-B-H 510	lb.	.15	.22
Resinex	lb.	.0325	.0425
Rubber Resin LM-4	lb.	.28	.35
Silene EF	ton	120.00	140.00
Silvacons	ton	55.00	85.00
Witcarb R	ton	105.00	120.00
-12	ton	45.00	66.00
Zeolex 23	ton	120.00	140.00
Zinc oxide, commercial†	lb.	.135	.1775

Retarders

Benzoic acid TBAO-2	lb.	.44	
E-S-E-N	lb.	.35	.37
Good-rite Vultrol	lb.	.62	.66
R-17 Resin	lb.	.1075	.36
Retarder ASA	lb.	.57	
J	lb.	.62	.64
PD	lb.	.35	.37
W	lb.	.45	
Retardex	lb.	.47	.50
Thionex	lb.	1.14	

Solvents

Bondogen	lb.	.55	.60
Butyrolactone	lb.	.60	.65
Cosol #1	gal.	.37	.43
#2	gal.	.42	.48
Dichloro Pentanes	lb.	.04	.07
Dipentene DD, Sunny South	gal.	.40	.62
Ethylene dichloride, comml.	lb.	.09	.1225
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27	.32
-748	gal.	.16	.23
n-Methyl-2-pyrrolidone	lb.	.75	.80
Neville Nos. 100, 104	gal.	.52	.60
106	gal.	.38	.46
Nevsolv H, 200	gal.	.19	.29
HF, [illegible]	[illegible]	.24	.34
Penetrell	gal.	$0.40	$0 62
Picco Hi-Solv Solvents	gal.	.16	.48
Pine Oil DD, Sunny South	lb.	.1225	.1425
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
Skellysolve-R, -V	gal.	.109	
-S	gal.	.099	
Stauffer Carbon Disulphide	lb.	.0525	.085
Tetrachloride	lb.	.0825	.475

Synthetic Rubber Monomers

Dow Styrene N99, H99	lb.	.205	
RG	lb.	.17	
Vinyltoluene	lb.	.17	
Hylene T	lb.	1.15	
TM, TM-65	lb.	1.05	
Monomer MG-1	lb.	1.00	1.25
Rohm & Haas ethyl acrylate	lb.	.34	
Methyl acrylate	lb.	.37	
Methacrylate	lb.	.29	.31

Synthetic Rubber Shortstops

DDM	lb.	.75	.88
Mercaptan 174	lb.	.38	.50
Shortstop 204	lb.	.33	.37
268	lb.	.52	.53
Tecquinol	lb.	.825	.845
Thiostop K	lb.	.53	
N	lb.	.41	

Tackifiers

American Resinous Chemical			
A25, A26, 716-30	lb.	.18	.19
555-40R	lb.	.185	.205
620-32B	lb.	.20	.21
716-35	lb.	.17	.18
1041-21	lb.	.165	.175
Acintol R	lb.	.065	.07
Bardol, 639	lb.	.0275	.0375
BRH 2	lb.	.0213	.0351
Bunarex Resins	lb.	.065	.1225
Chlorowax 70	lb.	.18	.24
Contogums	lb.	.0875	.11
Cumar Resins	lb.	$0.065	$0.17
Galex W-100	lb.	.155	.17
W-100D	lb.	.1525	.1625
Indopol H-35	gal.	65	.81
H-50	gal.	.70	.86
-100	gal.	.85	1.05
-300	gal.	1.00	1.21
L-10	gal.	.40	.56
-50	gal.	.45	.61
-100	gal.	.55	.71
Kenflex resins	lb.	.18	.27
Koresin	lb.	.90	1.10
Natac	lb.	.12	.13
Nevindene	lb.	.15	.18
Picco Resins	lb.	.13	.185
Piccolastic Resins	lb.	.1855	.34
Piccolyte Resins	lb.	.185	.25
Piccopale Resins	lb.	.089	.13
Piccoumaron Resins	lb.	.07	.185
R-B-H 510	lb.	.15	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.2475	.2625
United	gal.	.69	1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Ko-Blend I, S	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525	.38
Merck, Light Calcined	lb.	.2525	.26
Extra Light Calcined	lb.	.2925	.30
Red Lead (*See Accelerator-Activators, Inorganic*)			
Sulfasan R	lb.	1.50	
Sulfur flour, comml.	100 lbs.	2.30	3.05
Aero	100 lbs.	2.15	7.50
Crystex	lb.	.195	.23
Insoluble 60	lb.	.125	.13
Rubbermakers	100 lbs.	2.40	4.30
Stauffer	lb.	.024	.0515
Telloy	lb.	2.50	
VA-7	lb.	.50	.60
Vandex	lb.	15.50	
Vultac No. 2	lb.	.47	.755
3	lb.	.51	.795
White lead silicate (*See Accelerator-Activators, Inorganic*)			

CALENDAR of COMING EVENTS

September 19-21
Division of Rubber Chemistry, ACS. Chalfonte-Haddon Hall, Atlantic City, N. J.

September 27
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

September 28
Chicago Rubber Group.

October 2
The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.

October 5
New York Rubber Group. Fall Meeting. Henry Hudson Hotel, New York, N. Y.

Boston Rubber Group. Fall Meeting. Hotel Somerset, Boston, Mass.

October 22-26
National Safety Council. Forty-Fourth National Safety Congress and Exposition. Chicago, Ill.

(Rubber Section, October 22-23.)

October 26
Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.

October 30
Buffalo Rubber Group.

November 2
Chicago Rubber Group.

November 8
Rhode Island Rubber Club. Fall Meeting. Pawtucket Country Club.

November 8-9
National Research Council of Canada and Chemical Institute of Canada. Seventh Canadian High Polymer Forum. Guildwood Inn, Pt. Edward, Ont., Canada.

November 16
Connecticut Rubber Group.

November 25-30
American Society of Mechanical Engineers. Annual Meeting. Hotel Statler, New York, N. Y.

November 26-30
Twenty-Second National Exposition of Power & Mechanical Engineering. Coliseum, New York, N. Y.

November 27-30
Cleveland and Chicago Sections, ACS. Ninth National Chemical Exposition. Public Auditorium, Cleveland, O.

December 5
Buffalo Rubber Group. Christmas Party.

December 14
New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.

SITUATIONS WANTED (Continued)

TECHNICAL SALESMAN—Over twenty years' successful experience research, development, production, and sales elastomers, rubber, chemicals. Exceptional background paper and textile applications. High-level contacts. Seeks position sales development materials related to same fields. Northeast location preferred. Completely equipped home office, sample laboratory. Married, family, car. Address Box No. 1975, care of RUBBER WORLD.

CHEMIST, B. S., OVER 15 YEARS' EXPERIENCE IN COATings, laminations, pressure adhesives, emulsions, molded, extruded products, tapes, quarterlinings, is reliable and very thorough man for laboratory compounding and to follow-up compounds in production. Salary reasonable. Address Box No. 1976, care of RUBBER WORLD.

MATURE RUBBER CHEMIST, WELL ESTABLISHED IN RUBBER chemical sales, seeks position with manufacturer or distributor of compounding materials. Sales, Technical Service, Management. Excellent background in the industry. Address Box No. 1977, care of RUBBER WORLD.

MACHINERY & SUPPLIES FOR SALE

HARTIG 3¼" EXTRUDER & OTHER SIZES. STOKES & KUX 2½" dia. Single-Punch Preform Machines. Farrel 15" x 36" 2-roll Rubber Mill and sizes up to 84". New and used Lab 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders. Baker-Perkins & Day heavy-duty Jack. Mixers up to 150 gals. 200-ton Hydr. Press 20" x 80" platens. W. S. 150-ton Semi-Autom. Molding Press. Stokes 15-ton Fully-Autom. Molding Press, 150-ton 24" x 24" platens, 80-ton 20" x 20" platens. Large stock hydraulic presses 12" x 12" to 48" x 48" platens. Hydraulic Pumps and Accumulators. Rotary Cutters. Stokes Molding Presses. Single-Punch & Rotary Preform Machines. Banbury Mixers, Crushers, Churns, Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107—8th Street, Brooklyn 15, N. Y. STerling 8-1944.

2—BALL & JEWELL #1½ ROTARY CUTTERS WITH 30 HP motors.
Stokes preform Presses—Model T—R & 294.
Thropp 2-roll Mill, 6" x 12", with 7½-HP gearhead motor.
Farrel 16" x 48" Calender with drive & motor.
W & P Mixers, all sizes. Farrel 18" x 42" Mill Rolls, adjustable by motor, with drive & motor.

EQUIPMENT CLEARING HOUSE, INC.,
111—33rd Street,
Brooklyn 32, N. Y.

FOR SALE: 1—FARREL 16 x 48" 3-ROLL CALENDER; 1—ROYLE #2 extruder; 1—37 x 37" 10-opening hydraulic press with 30" ram; 1—16 x 30" cracker mill, 50 HP; also mixers, vulcanizers, cutters, etc. CHEMICAL & PROCESS MACHINERY CORP., 52 Ninth Street, Brooklyn 15, N. Y.

EXCEPTIONAL EQUIPMENT JUST PURCHASED FOR RESALE: Hydraulic Presses, 600-ton, 300-ton, 125-ton, and 35-ton, all with heated platens; Heavy-duty Baker-Perkins double-arm jacketed Mixers, 300 gal., 200 gal., and 100 gal.; Brand NEW Falcon double-ribbon Mixers in stainless or steel, all sizes in stock; Devine No. 23 Vacuum Chamber Dryer, dbl. door, 13 shelves 59" x 78", complete with all accessories; Stokes Preform and Pelleting Presses; Extruders, Strainers, Tubers, Injection and other Molding Presses; Rubber Mills, Calenders, Vulcanizers, Bale Cutters, Rotary Cutters. For fast accurate reply to your inquiry write to FIRST MACHINERY CORP., 209 Tenth St., Brooklyn 15, N. Y.

Custom Mixing

RUBBER-PLASTICS

We do milling and compounding of all types—black or color—master batches

All mixing done under careful supervision and laboratory control.

Phone: Butler 9-0400

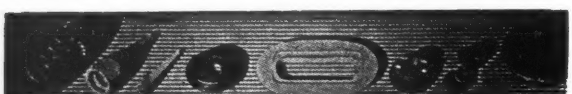
Pequanoc Rubber Co.

MANUFACTURERS OF RECLAIMED RUBBER
MAIN SALES OFFICE and FACTORY: BUTLER, N. J.

MANUFACTURING BUSINESS WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained. Address all replies "confidentially" C. J. GALE, Sec., P. O. Box 1351, Church St. Station, New York 8, N. Y.

The Classified Ad Columns of RUBBER WORLD bring prompt results at low cost.



INDUSTRIAL RUBBER GOODS

BLOWN — SOLID — SPONGE
FROM NATURAL, RECLAIMED, AND SYNTHETIC RUBBER

THE BARR RUBBER PRODUCTS CO. SANDUSKY OHIO

MACHINERY & SUPPLIES FOR SALE (Continued)

FOR SALE; MARCO PROCESS CONSISTING OF: KACR REactor, Kom-bi-nators, Homogenizer, Roto-Feed Mixers, proportioners, etc., all stainless steel. Double-Arm Sigma Blade Jacketed Mixers: (2) Read 50 gal., 30 HP; (2) W & P 100 gal.; (2) Day 75-gal. st. st.; Kux model 25 rotary pellet presses, 21 and 25 punch. (7) Devine Vacuum Shelf Dryers #17, #23, #27. WE BUY SURPLUS EQUIPMENT. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

MACHINERY & SUPPLIES WANTED

WANTED: PLANT OR MACHINERY INCL. RUBBER MILLS, Calenders, Mixers, Banbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO.•INC., 64 Bloomfield Street, Hoboken, N. J. BArclay 7-0600.

ONE 3-ROLL VERTICAL LAB CALENDER IN GOOD CONDITION; also tape testing lab equipment. Address Box No. 1978, care of RUBBER WORLD.

WANTED: HYDRAULIC PRESS 20 to 26" UPSTROKE RAM. WITH eight 3" steam platens 42" x 42", 315- to 500-ton. ALCO MACHY & SUPPLY CO., 5 Beekman St., New York, N. Y. WOrth 4-7875.

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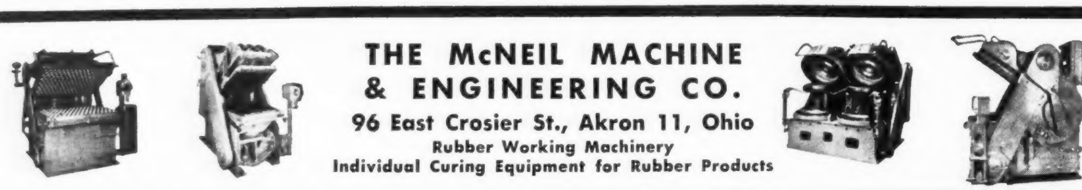

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